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**The UK's wealth distribution and characteristics of
high-wealth households**

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THE UK'S WEALTH DISTRIBUTION AND CHARACTERISTICS OF HIGH-WEALTH HOUSEHOLDS

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Abstract

We show that wealth inequality in the UK is high and has increased slightly over the past decade as financial asset prices increased in the wake of the financial crisis. But data deficiencies are a major barrier in understanding the true distribution, composition and size of household wealth. The most comprehensive survey of household wealth in the UK does a good job of capturing the vast majority of the wealth distribution, but that nearly £800 billion of wealth held by the very wealthiest UK households is missing. We also find tentative evidence that survey measures of high-wealth families undervalue their assets – our central estimate of the true value of wealth held by households in the UK is 5% higher than the survey data suggests.

1. Introduction

In high-income Western economies during much of the twentieth century, economic questions of distribution – of income or other variables – seemed of secondary importance to those of macroeconomic growth (Lucas, 1988; Krugman, 1997). This focus for research was more understandable in an era of economic expansion, broadly rising living standards and falling inequality. But in the past 40 years trends of falling inequality have faltered or even reversed (Atkinson, 2005; Atkinson and Piketty, 2007; Piketty and Saez, 2003). More recently, trends in growth and productivity have slowed down too (Crafts, 2018; Crafts and Mills, 2020). With a lag, economists' interests have followed suit: high-profile research on income distribution paved the way for a more recent wider focus on other types of inequality such as that of wealth, particularly since the publication of *Capital in the Twenty-First Century* (Piketty, 2014; Garbinti, Goupille-Lebret and Piketty, 2021; Saez and Zucman, 2016, 2020a,b; Smith Zidar Zwick 2020; Artola Blanco, Bauluz and Martínez-Toledano, 2021). This research has led policymakers to think more about the distribution and growth of wealth, as well as options for taxing it (Advani, Chamberlain and Summers, 2020a).

This paper studies the wealth distribution of the UK.¹ Using survey data on private wealth we estimate wealth inequality, the composition of wealth holdings, and the characteristics of high wealth households. We then augment the survey measure using data from the Sunday Times Rich List (STRL) and a Pareto distribution-based imputation for 'missing wealth'. We find that true levels of wealth (and of wealth inequality) are substantially higher than those shown in statistics based purely on surveys.

A detailed understanding of the distribution of wealth matters when designing wealth taxes in at least three distinct ways. First, it helps policymakers to gauge the likely welfare impact of changes to the tax regime for wealth: in particular what the characteristics of people affected would be with respect to present income, age, location and other key variables. Second, to the extent that taxation seeks to reduce inequality in well-being, wealth may directly influence this well-being so be the proper subject of independent taxation (Saez and Stantcheva, 2018). It is therefore necessary to understand how wealth is distributed. It is worth noting, however, that whether wealth contains more information about lifetime resources than can be learned from income and consumption is a matter of some controversy (Adam and Miller, 2021). Third, the combination of tax structure and wealth distribution – along with any behavioural responses to the tax – determine how much revenue will be raised (Advani, Hughson and Tarrant, 2021).

Distributional analysis of wealth ownership demands a dataset that measures both wealth and other personal characteristics. At present, the ONS Wealth and Assets Survey (WAS) is the only such comprehensive dataset available for Great Britain,² so it forms the core of our analysis. We

¹ Though we refer to the UK throughout this paper, our data exclude Northern Ireland, Northern Scotland (north of the Caledonian canal), and individuals living in residential institutions such as prisons, university accommodation, and care homes. As a result, we miss around 2% of the UK population. Unless these areas are drastically different from the rest of the UK, it is unlikely that our distributional results are substantially affected. In principle, if the distribution of wealth in these areas is identical to what we observe elsewhere, we could increase our aggregate measures of wealth by 2%, but given the inherent uncertainty involved in using survey data, we do not take this approach, and we do not expect it to change our results substantially. We *do* include some of the wealthiest individuals in the areas omitted from the survey data, as these individuals are captured in the Sunday Times Rich List which we use to supplement our estimates.

² Unfortunately, there is no comprehensive survey of wealth in Northern Ireland comparable to the ONS Wealth and Assets Survey, though Hillyard, Patsios and Feely (2014) do provide some evidence on wealth held in Northern Ireland to which the interested reader may refer.

find that the top three household net wealth deciles held a larger share of wealth in 2016–18 than ten years earlier, and the middle 50% shrank. This has been driven by rising financial wealth relative to property wealth. Importantly, average gains in financial wealth over the past decade are explained more by passive capital gains than by active saving,³ and wealth gains have accrued mostly to families that already held financial assets. We find that a major driver of rising inequality is that wealthy families' financial portfolios contain a greater share of high-yielding assets (consistent with Bach, Calvet and Sodini, 2020; Fagereng et al., 2020), and show that population ageing alone does not explain very much of the recent change in the distribution of wealth.

Lower wealth households (the second and third net wealth decile) have a larger share of wealth in physical assets (largely consumer durables) than in other broad asset classes, while wealth for the fifth to eighth deciles is dominated by property, and for the top two deciles dominated by pensions. Financial wealth is much more prevalent in the wealthiest decile, and its composition varies substantially across net wealth deciles, though even the wealthiest families have a significant share in low-yielding assets. Bach, Calvet and Sodini (2020) report similar findings in Sweden, with pensions and home equity more substantial towards the bottom and middle of the distribution, but a growing importance of financial wealth and towards the top, and private business wealth at the very top. This pattern is replicated again in France (Garbinti, Goupille-Lebret and Piketty, 2021).

We also consider the characteristics of high-wealth families who would likely be impacted by the introduction of a wealth tax, and the types of wealth they hold. They are clustered in working-age cohorts close to retirement, and are more likely to be male than female. There are large geographical divides, with high-wealth families much more concentrated in the South East of England than in the rest of Great Britain. They are also largely a stable population over time with relatively little movement into the top: 80% of those in the top decile of wealth in 2014–16 remained in the top decile two years later, and almost all (90%) entrants to this group came from the next decile. Finally, the composition of high-wealth families' wealth holdings is much more dominated by business and financial assets (and relatively less by property and pensions) for those families with net wealth over £5 million per adult than for families with lower wealth levels.

A well-known problem with household surveys is that it can be difficult to capture a complete representative sample of all individuals: top individuals are typically under-covered (Jenkins, 2017; Burkhauser et al., 2018; Advani, Summers and Tarrant, 2021). Capital income is particularly likely to be under-estimated (Advani, Ooms and Summers, 2021), so the problem of under-coverage may be more severe for wealth (i.e. capital holdings). We explore this problem, with a particular focus on the very wealthiest families in the UK, using the Sunday Times Rich List. Our analysis finds that the WAS does a remarkably good job at capturing some of the wealthiest people in the UK but that there is likely to be at least some undercount in official estimates of total wealth. Further, we find evidence from fitting a Pareto distribution to UK wealth data (often found to be a good fit of the upper wealth tail of the wealth distribution in a range of contexts) that both the WAS and the STRL underestimate family wealth at the very top of the distribution. Adjusting for these deficiencies by adding in wealth captured in the STRL that is not captured in the WAS, and subsequently accounting for additional missing wealth using a Pareto adjustment, increases survey estimates of total wealth by 5% in our central estimate, adding almost £800 billion in wealth. Around half of this comes from simply adding wealth captured in the STRL that is not recorded in the WAS.

³ See Corlett, Advani and Summers (2020) for more information on capital gains.

Our findings extend existing information about both aggregate wealth and the concentration of wealth at the top. There exist a number of existing aggregate wealth series for the UK, including based on the national accounts (World Inequality Database, n.d.), inheritance tax records (HMRC, 2005; Alvaredo, Atkinson and Morelli, 2018) and the Wealth and Assets Survey (ONS, 2019a; Credit Suisse, 2019). These series reach quite different results as to total wealth in the UK (Advani, Chamberlain and Summers, 2020b), in part because they have different target definitions of wealth. We provide a precise definition of, conceptually, what it is we think ought to be measured when considering private wealth that would potentially be relevant for a wealth tax. Using the WAS, we are able to provide up-to-date numbers on both aggregate wealth and the concentration of wealth. Relative to previous estimates on top wealth for the UK (Vermeulen, 2018), our top wealth adjustment uses a relatively large sample of top wealth observations (1000 in the STRL), and our Pareto adjustment focuses on adjusting business wealth from the WAS, which we argue is more closely related to what is being measured in the top wealth data. The effect of these adjustments – as well as the inclusion of business wealth – is that aggregate wealth is higher than UK official figures (ONS, 2019a), as is the share of wealth going to the top decile. Our estimates for the share of wealth held by the top 1 per cent and top 10 per cent are higher than previous academic estimates for the UK (Alvaredo et al., 2018; Vermeulen, 2018). This brings the UK in line with the equivalent shares in France (Garbinti, Goupille-Lebret and Piketty, 2021), though still substantially below that of the US (Piketty, Saez and Zucman, 2018).

Beyond these headline numbers, our data allow us to describe the characteristics of both wealth holders and their wealth at difference points of the wealth distribution. Understanding more about who receives top income has been an important focus of recent academic work (Bell and Van Reenen, 2014; Piketty, Saez and Zucman, 2018; Smith et al., 2019; Advani and Summers, 2020b; Advani et al., 2020a), but much less is known about recipients of top wealth since wealth figures are often constructed indirectly, based on tax data which are much more limited in the demographic information they contain. Using survey data, our unadjusted top share wealth numbers match tax-based top shares for the UK (Alvaredo et al., 2018), but we observe wealth measured alongside other demographic information so can speak to these wider questions (Fagereng et al., 2020; Runnymede Trust, 2020). We can also study not only individual wealth but *family* wealth – something that is not observable in UK tax data, where tax is (predominantly) individual. This is important because wealth is often shared within families.

Finally, we make a methodological contribution by clarifying what can be learned from different types of data source on wealth. Researchers wishing to study the wealth distribution have access to a number of possible data sources: household surveys, administrative data from income and inheritance tax, and lists of large wealth-holders (Alvaredo, Atkinson and Morelli, 2016; Crawford, Innes and O’Dea, 2016). We highlight both what these can tell us about the ownership of wealth, as well as the limitations of the different methods for studying the amount and distribution of wealth.

The rest of the paper proceeds as follows. Section 2 details the available data in the UK on household wealth, and the approach we have taken to analyse it. Section 3 describes the size and distribution of household wealth in the UK. Section 4 analyses the gaps in the available data, and the impact on estimates of the wealth distribution after accounting for deficiencies in data coverage. The conclusion summarises our findings and their implications for the rest of the project.

2. Data and methodology

The primary challenge in understanding the scale and distribution of wealth in the UK is the data available for research. Broadly speaking, there are three key types of data: first, survey-based data collecting households' self-reported wealth holdings – key here is the Office for National Statistics' (ONS) Wealth and Assets Survey (WAS); second, administrative data collected for tax purposes, one example is the data on the value of estates at death for inheritance tax; and finally, data compiled for other purposes such as the Sunday Times Rich List (STRL). Each of the datasets entails significant challenges in allowing us to produce comprehensive estimates of the distribution of wealth in the UK (for a wider discussion see Alvaredo, Atkinson and Morelli, 2016).

2.1 Survey data

The WAS provides the most comprehensive wealth data available in the UK, both in terms of who it covers and what assets are covered. It has been conducted since 2006 with the purpose of capturing very granular information on the value of household wealth – both assets and liabilities – at the individual and household level. The ONS produces summary statistics and allows researchers access to anonymised microdata.⁴ This allows us to produce detailed analysis by asset and liability type broken down by key characteristics of the individual or household.

The WAS samples private households with an address in Great Britain. In principle, this means the survey could capture those who only live in Great Britain part-time who are not strictly 'resident', though in practice it is unlikely that many such individuals respond to the survey. Individuals who are resident but non-citizen are also within the scope of the survey.⁵ The survey is unlikely to fully capture the wealth of families where one family member lives outside the UK, as this individual would not be interviewed or classified as a member of the household, and their wealth (unless owned jointly with an eligible household member) would not be captured. The sample excludes individuals living in residential institutions, such as retirement homes, nursing homes, prisons, barracks or university halls of residence, and homeless people. We therefore do not observe the wealth of these individuals, who number approximately 1.2 million (Corlett et al., 2018).

There are three major challenges that face researchers using the WAS. First, the time series is relatively short which does not allow the data to be placed within its long-run historical context. Second, it is hard to value some types of assets (largely non-financial assets) which do not have a clear market price; the survey is designed to rely on the self-reported subjective value of these assets which may introduce biased valuations.⁶ Third, and perhaps most importantly for this paper, some wealth is unlikely to be captured by the WAS. This is due to unit non-response where richer households are less likely to respond to the survey,⁷ item non-response where survey respondents fail to include their assets, particularly business assets, and indirect holding of wealth through trusts and other vehicles, particularly at the very top of the distribution. Despite these challenges, the WAS remains the best source of data on the wealth holdings across much of the UK's wealth distribution; indeed, since its inception, the survey has formed

⁴ See, for example, ONS (2020).

⁵ We discuss data issues relating to residency and citizenship further in Section 4.3.

⁶ Appleyard and Rowlingson (2010) note that there is some evidence of overestimating the value of housing in early waves of the WAS, and the same appears to be true in later waves (ONS, 2018). We discuss this issue further in Section 4.3).

⁷ The ONS attempt to account for lower response rates among wealthier households by over-sampling households identified ex ante as likely to be in the wealthiest tenth of households.

the bedrock of much of the recent analysis of wealth in the UK, for example, Crawford, Innes and O'Dea (2016) and D'Arcy and Gardiner (2017).

2.2 Administrative data

For analysing changes to existing taxes, administrative data have the clear advantage of covering the full population of those paying the tax. But the UK does not have an existing comprehensive wealth tax meaning that there is no complete administrative dataset on wealth holdings in the UK. Inheritance tax data are available for taxable wealth held at death by people whose estates require probate.⁸ Capital income taxes (taxes on income from wealth) mean administrative data also cover wealth which produces taxable income, from which it is possible to estimate the value of the underlying asset,⁹ but assets which don't generate income will be missed, such as owner-occupied homes. While consistency of definition and legal requirements to report ensure that administrative data are of good quality for individuals who are required to report, not all individuals, and not all assets, will be covered. For example, inheritance tax data only cover around half of the population, and there is no requirement to report the value of assets which are not subject to taxation, such as pensions. It is not clear to what extent inheritance tax data cover even the top of the distribution. There is no empirical evidence on how the likelihood of requiring probate varies across the wealth distribution, and there is an established tax advice industry helping the wealthy to avoid both inheritance tax and the probate process. Tax planning may also affect the extent to which reported wealth captured accurately reflects the wealth of the living population. For example, most lifetime gifts of cash do not need to be reported however substantial, unless the donor dies within seven years, and such transfers of wealth do not have to be shown on any probate forms or on the recipient's tax return.

Some of these administrative data have been used to analyse the top of the UK's wealth distribution in previous research – specifically inheritance tax data. Alvaredo, Atkinson and Morelli (2018) estimate the share of wealth at the top of the distribution since the nineteenth century, using 'mortality multipliers' that treat the deceased as a sample of the living population. This approach is valuable as it would theoretically capture all high-wealth estates and thus is not subject to the high-wealth unit non-response present in the WAS. However, though inheritance tax data capture 100% of estates with an inheritance tax liability, it may fail to capture the wealth held in estates valued above the exemption threshold (currently £325,000 per person) if no inheritance tax is due, even if probate is required. This is because non-taxpaying estates, such as those where the deceased is resident but non-domiciled,¹⁰ or estates claiming exemptions and reliefs,¹¹ are not necessarily required to report all assets. A further concern is that the wealth observed on death is not representative of the wealth of the living as individuals nearing death may engage in 'deathbed planning'.

⁸ Despite the name, inheritance tax (IHT) data cover all estates requiring probate, regardless of whether any IHT is due on the estate. This means that they cover estates valued below the exemption threshold for IHT (currently £325,000), if probate is required on at least one of the assets making up the estate.

⁹ This approach estimates the level of wealth across the distribution by applying asset return rates to more readily observed capital income. However, it is very sensitive to assumptions about the rate of return, with small differences in return rate assumptions leading to large changes in estimated wealth – see Smith, Zidar and Zwick (2020), and Saez and Zucman (2020a, 2020b).

¹⁰ If the deceased is non-domiciled, inheritance tax is only due on assets located in the UK, and they are not obliged to report the total value of worldwide assets. Conversely, the data include the estates of individuals who are domiciled but are not resident in the UK, as these are chargeable to IHT.

¹¹ Some assets classes receive full tax relief (such as agricultural and business property); while data is available for these assets, they may not properly reflect true values because the tax authority has no incentive to check submissions given their exclusion from tax liability.

But the major drawback, in so far as we would want to study the whole wealth distribution, is that inheritance tax data fail to capture key parts of it. Inheritance tax data only cover estates requiring probate, which is roughly half of all estates passing on death (HMRC, 2019, p.4). Many smaller estates do not require probate, nor do estates which are jointly held and pass automatically to the surviving spouse (potentially including some high-value estates). There are no hard rules determining whether probate is required, and it is difficult to establish how probate incidence, and thus inclusion in the data, varies across the wealth distribution. Estates data also do not cover all asset classes, with pension assets and some assets held in trust being excluded. This means that the data are insufficient for the purpose of this paper to summarise the entire wealth distribution.

2.3 Adjusting top wealth

The approach taken in this paper is to rely on the WAS as the basis for the primary analysis (see Section 3) as it is the most comprehensive and detailed summary of household wealth. Following these results, we provide analysis of the scale of any missing wealth not covered by the WAS and indicative results after adjusting for these gaps (see Section 4).

In order to calculate the amount of wealth at the top of the wealth distribution which is not captured by the WAS, we utilise the STRL which provides summaries of the wealth held by the wealthiest individuals and families in the UK. Unfortunately, these two datasets are not completely comparable; this is unsurprising given that the STRL data is produced primarily from holdings of business assets and does not include other asset types, such as housing (Watts, 2020). The authors also take a cautious approach with liabilities, to ensure that the wealth of those at the top is not over-estimated. The STRL is therefore best thought of as a lower bound on the wealth levels of the very wealthiest families in the UK.¹²

Combining the STRL and the WAS will capture more of the wealth distribution than either does alone but it is possible that there will be wealth holdings which are not properly captured by either dataset. In order to estimate this potential gap, we utilise an approach taken by Vermeulen (2018) and Bach, Thiemann and Zucco (2019). This approach assumes that the top tail of the wealth distribution matches a Pareto distribution, which is commonly found to be the case for both the wealth and income distributions (Jones, 2015). The Pareto distribution is estimated using the combined WAS and STRL sample. The total estimated wealth under the full Pareto distribution is then compared to the survey data – if the data is found to underestimate total wealth relative to the Pareto distribution, then that represents the missing wealth not captured by either survey.

2.4 What wealth and for whom?

There are two final important methodological considerations: what assets are included within the definition of total wealth and what is the appropriate economic unit to analyse.

What wealth

The definition of wealth is not straightforward. For example, private pension assets are not readily convertible into other forms of wealth for someone of working age and therefore have

¹² STRL data are (in some cases) reported for ‘families’ rather than individuals or households as defined in WAS. In our analysis of the combined WAS and STRL data, we use household-level WAS data, and assume each observation in the STRL represents one household. It is also worth noting that from conversations with a number of advisors to the ultrawealthy, there are a number of very high wealth families who are not covered by the STRL data, not least because they may use vehicles such as trusts and foundations to hold wealth, making it difficult to identify their wealth.

no direct impact on living standards, although awareness of future pension receipts may affect one's current desire to save. There is no inherently correct answer, rather the definition of wealth depends on the purpose for which it is being used. We take an approach which attempts to be as comprehensive as possible in measuring private wealth, and excludes other wealth. This means our primary definition of net wealth includes all private pension assets, financial assets, other business assets, physical assets and property assets net of formal and informal financial liabilities. This definition has both principled and practical benefits. In principle it is clear, drawing a line between assets which one has a legal claim to, which is the definition that would be most appropriate for a wealth tax (Advani, Chamberlain and Summers, 2020), and those one does not. It is also easier to implement in practice because – while there are still many challenging valuation issues (Daly, Hughson and Loutzenhiser, 2021) – the assets that are included are relatively easier to attach financial values to than other items which might be considered as part of wealth (e.g. human capital).

Accordingly, we do not include a measure of the expected individual value for future state pension (social security) payments. Clearly there is a relationship between the existence of state pensions and household saving decisions (Lachowska and Myck, 2018) but there is no contractual obligation for the government to maintain future pension payments at levels currently expected. In which case, if one wanted to include such benefits, a more consistent alternative approach would be to include the effective value of an individual's entitlement to the entire existing social security system, rather than pensions specifically. As explained above, such wealth is outside the scope of what we intend to measure. If we were to include it, our conjecture is that it would largely represent a level shift in wealth holdings (albeit varying by age and other characteristics) and not substantially affect our analysis of high wealth families. Clearly this 'wealth' would not be relevant for a government if it were considering introducing a wealth tax. For the same reasons we also do not include wider measures of wealth, such as the benefit an individual gets from the environment and other natural assets (Dasgupta, 2021).

The economic rationale behind excluding human capital is more difficult. Again we exclude it because there is no straightforward measure available, one doesn't have a legal claim over it, and it could not realistically be directly taxed. However, it clearly varies substantially across individuals and economically it is an important store of value, with a large share of investment by young people taking the form of human capital (Jorgenson and Pachon, 1983). It is likely to be positively correlated with wealth, since human capital is positively related to income, and income rank is correlated with wealth rank (Jäntti et al., 2013; Kuhn et al., 2020; Fisher et al., 2021). Much of the return to human capital is received as (financial) income over the course of an individual's working life, so the value of it is also likely to be negatively correlated with age as the number of remaining working years reduces. Estimates of wealth inequality that included human capital would therefore likely have higher levels of inequality, but a shallower age gradient. Although we do not attempt to measure this directly for the reasons set out above, we approximate a cross-sectional measure of wealth inequality accounting for human capital by showing wealth inequality among wealth holders close to retirement (see Appendix F). Retirement is the decision to stop receiving a financial return on the human capital an individual has built up. This does not mean that the human capital disappears, and access to it still provides insurance for retirees who may return to the labour market if needed. However, despite this possibility of return, we can think of retirement as a reasonable proxy for the exhaustion of human capital, so that (to a first approximation) on retirement tangible and financial assets are the only personal wealth an individual owns. The exclusion of human capital is therefore likely to have a much smaller effect on individual wealth, although it is worth noting there are many other aspects that will still not be captured, such as differences in health capital, and social capital.

We make two adjustments to the survey data. First, we reduce the reported value of physical assets. These are inherently hard to value as there are important choices about whether to measure the replacement value, market value, insurance value or something else (Daly et al., 2021), and the WAS survey design does not always ask for consistent valuations for wealth. Since we wish to capture market value, we reduced the reported value of home contents, theoretically measured at replacement value, by 75% to be more consistent with market values of other asset classes (this is broadly in line with the analysis of new vs used eBay data by Advani, Hughson and Tarrant, 2021).

Second, we impute some additional business wealth in the early waves of WAS. There has been a substantial expansion in the coverage of business wealth in WAS over time. This has resulted in a doubling of the number of individuals reporting non-zero business wealth in recent rounds, compared with the earlier years of WAS. In the first wave of the survey (covering 2006-2008), almost 97 per cent of survey respondents were classified as not having private business wealth; this fell to 95 per cent in the latest round of the survey (with the most recent round of the survey reasonably closely matching business population estimates, suggesting good coverage). The improvement in data coverage appears to have primarily been driven by improvements in the survey questions, with the number of private business wealth-related variables increasing by around two thirds. Since the current round lines up well with external aggregates, our view is that this is accurate. We are therefore confident in the baseline wealth we measure in WAS in the most recent round. To account for undercoverage of business wealth in the earlier period, we impute wealth back into the previous waves, which raises historic measured baseline wealth. If instead one thought that the WAS measure of business wealth were correct historically (or even just that business wealth were historically much lower than at present), our approach would overestimate the level of wealth held by top shares historically, and consequently underestimate the growth of top share inequality.

Whose wealth

Wealth can be measured for different economic units: individuals, families (meaning single adults or couples with any dependent children) or households (meaning everyone living in the same dwelling).¹³ There are advantages and disadvantages of taking different approaches. It is more natural to think about wealth as held by the family unit given that resources are typically shared freely between members of a family. But there tend to be differences between individuals within families – one obvious example is that women tend to have much lower pension wealth as a result of lower average wages and the likelihood of taking time out of the labour market for childcare (B&CE, 2019). This means that analysis at the household or family level can under-represent some of the inequalities in wealth holdings. For the analysis which follows, we rely on wealth per adult within family units. Appendices B, C and D repeat much of the analysis in Section 3 based on alternative economic unit definitions.

¹³ Often households and family units will overlap but not always – for example, family units would treat adult children living with parents as separate families.

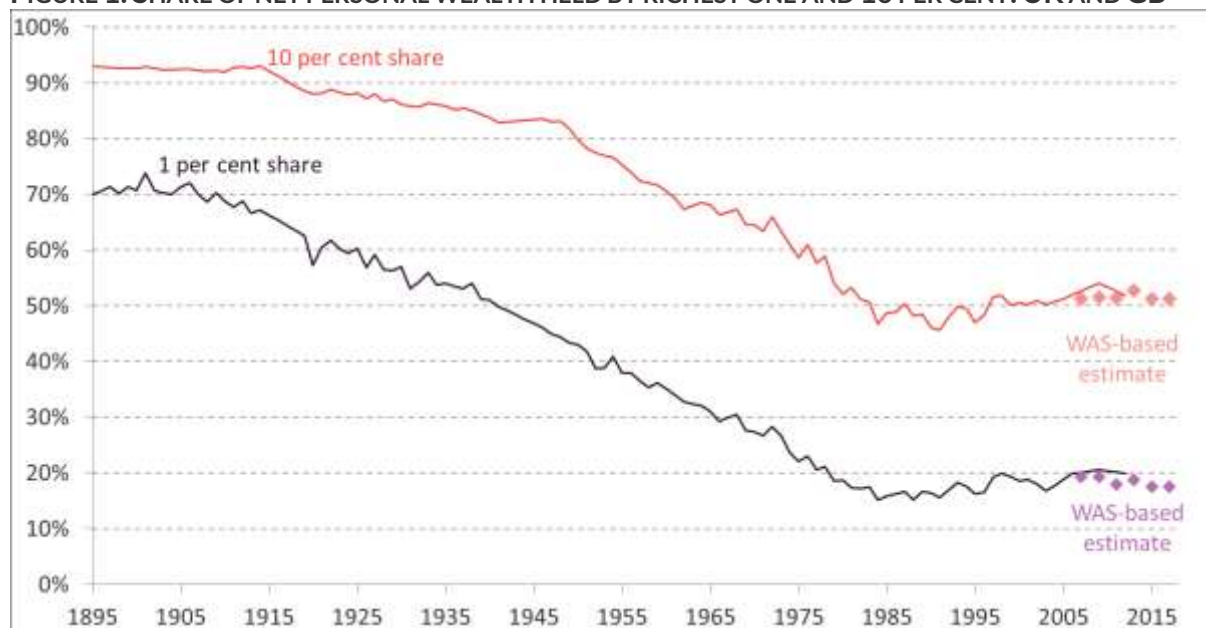
3. The distribution of UK household wealth

3.1 Inequality in household wealth

Household wealth in the UK is large and is held very unequally. Total net household wealth as a share of national income has approximately doubled over the past thirty years (Bangham and Leslie, 2020). Measures of wealth inequality suggest that it is twice as unequally held as income (Crawford, Innes and O'Dea, 2016).¹⁴ Understanding the size and shape of wealth in the UK is vitally important for policymakers and is an important context for the increasing interest in wealth taxes in the UK. This section explores the topic in more depth.

Long-run estimates of the UK wealth distribution (Figure 1) show that the share of wealth at the top of the distribution fell markedly during the early and mid-twentieth Century, since then top wealth shares have remained fairly stable.¹⁵ This is a trend which has been repeated across many countries (Piketty, 2014). It is partially a function of similar changes in income inequality; naturally, those with higher income are more likely to be able to save and thus accumulate wealth over time (Dynan, Skinner and Zeldes, 2004). But, as discussed later, there are significant macroeconomic trends which influence the size of wealth and the shape of the wealth distribution which are unrelated to the broader trends affecting income inequality. In other words, more recent changes in wealth are less to do with income and saving than they would have been in the past.

FIGURE 1: SHARE OF NET PERSONAL WEALTH HELD BY RICHEST ONE AND 10 PER CENT: UK AND GB



Notes: World inequality database estimates refer to the whole of the UK and the WAS-based estimates exclude Northern Ireland. Due to changes in the coverage of business assets between survey rounds in the WAS, these results are adjusted using the latest observation of private business wealth shares held by the top 10% and 1% in the most recent round of the survey (2016–18) and imputed backwards to provide a consistent estimate. The definition of wealth used for the long-run estimates is not consistent with that from the WAS; Appendix A provides alternative estimates of top wealth shares which address some of these differences.

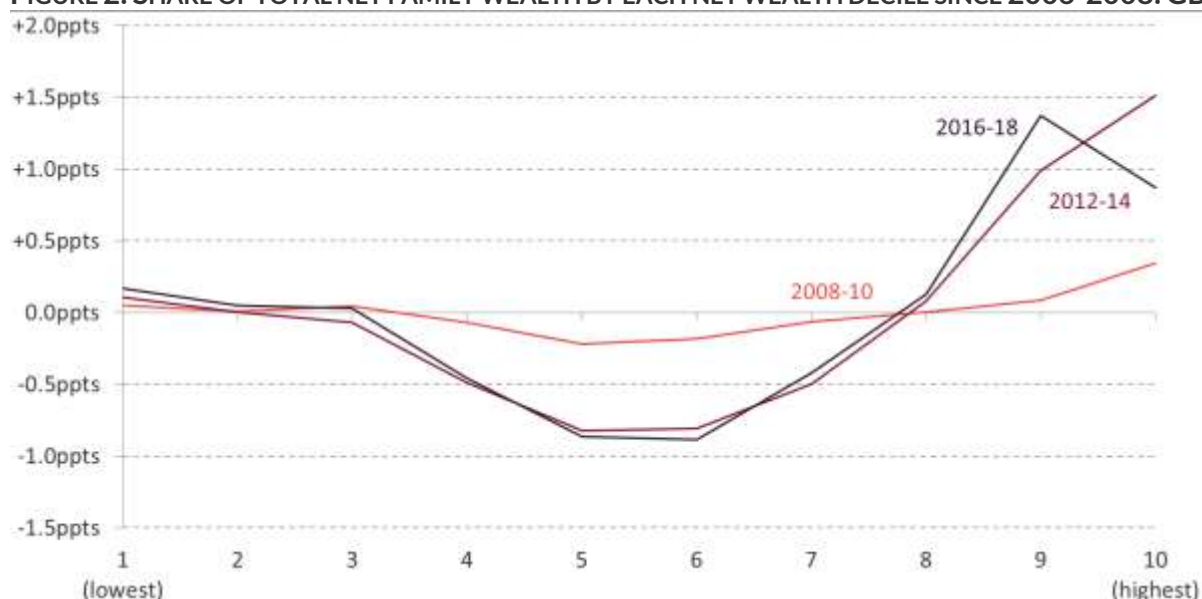
¹⁴ However, recent work by Advani and Summers (2020b) suggests income inequality is being under-measured, so is somewhat closer to wealth inequality.

¹⁵ We later show how these results are changed by the imputation of under-reported wealth. In Appendix A we also show that the level and dynamics of wealth inequality in recent years depends on the definition of wealth used.

Source: Alvaredo, Atkinson and Morelli, 2018, obtained from the World Inequality Database, 2020; ONS, Wealth and Assets Survey.

Drilling down into the available WAS data (which starts in 2006), we can see that there has been a compositional shift in the wealth distribution: wealthier families hold a higher share of wealth today than was the case a decade ago, while those in the middle hold a smaller share of wealth (Figure 2). This shift is relatively small when compared to the changes seen throughout the twentieth century. A commonly used alternative measure of inequality, the Gini coefficient, has shown a very slight rise in inequality over this period, going from 0.61 in 2006–2008 to 0.63 in 2016–2018 (ONS, 2019a). This suggests a smaller rise in inequality than that implied by the rise in share of wealth held at the top, because the increase in top-wealth shares has been offset by small improvements at the bottom of the wealth distribution.

FIGURE 2: SHARE OF TOTAL NET FAMILY WEALTH BY EACH NET WEALTH DECILE SINCE 2006-2008: GB



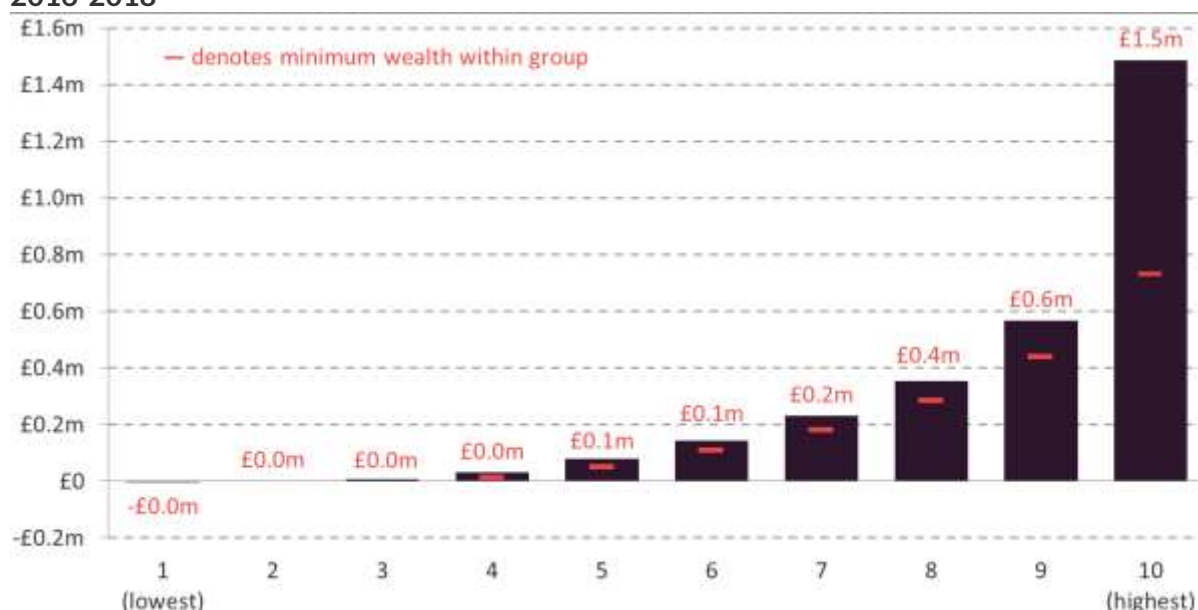
Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets, pension assets, and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.). Private business assets are excluded due to material improvements in the coverage of these assets since the early rounds of the survey making cross-round comparisons difficult, given the level of uncertainty about how business wealth should be imputed at decile level. Figure B1 shows the same graph constructed using individuals as the unit of analysis.

Source: ONS, Wealth and Assets Survey.

Unsurprisingly, wealth levels vary substantially across the distribution. The average family in the poorest 10% of families has negative net wealth – i.e. their debts exceed their assets, while the median family has just over £100,000 in net wealth per adult and the top 1% has almost £5 million per adult in the family.¹⁶ Figure 3a and b show the average wealth holdings for each adult within family groups across the wealth distribution. The large gaps between families has a profound effect on living standards as well as mobility across the wealth distribution. To put the scale of these gaps in context, the UK median net disposable household income was around £23,000 in 2018–19 (Brewer et al., 2020); it would require more than 400 years for the median household saving all disposable income to move from median wealth to reach the average wealth of the richest 1%.

¹⁶ Note that a family who are ‘just’ in the top 1% have £1.9 million wealth per adult. The mean per-adult wealth of a family in the top 1% is much higher than this because it is an average that includes the extremely high wealth of those at the very top of the distribution.

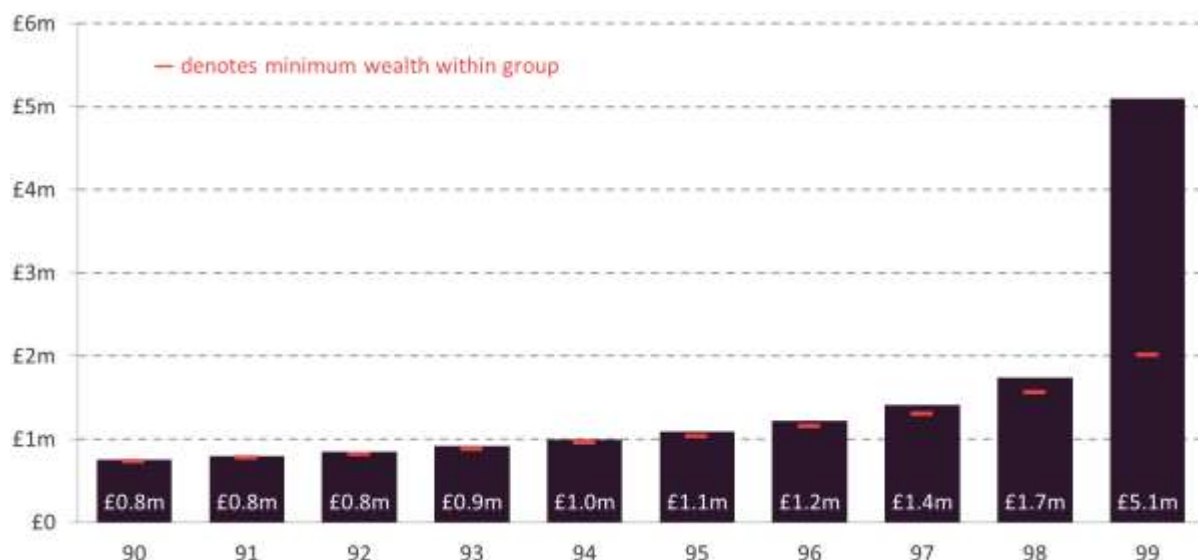
FIGURE 3A: AVERAGE NET WEALTH PER ADULT PER FAMILY WITHIN EACH NET WEALTH DECILE: GB, 2016-2018



Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc). Figures B2 and C1 show this graph using individuals and households as the unit of analysis, respectively. Figure D1 shows this graph using an alternative wealth definition which excludes main homes and pension wealth.

Source: ONS, Wealth and Assets Survey.

FIGURE 3B: AVERAGE NET WEALTH PER ADULT PER FAMILY WITHIN EACH NET WEALTH PERCENTILE FOR THE WEALTHIEST 10 PER CENT: GB, 2016-2018



Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc). Figures B3 and C2 show this graph using individuals and households as the unit of analysis, respectively. Figure D2 shows this graph using an alternative wealth definition which excludes main homes and pension wealth.

Source: ONS, Wealth and Assets Survey.

3.2 Composition of household wealth

Household wealth in the WAS is decomposed into five asset classes: property wealth (net), physical wealth, private pension wealth, financial wealth (net), and business assets. Net property wealth consists of self-valuations of any property owned by the household, net of any loans or mortgages secured on the property. Physical wealth includes the estimated value of all household contents, including antiques, artwork, and vehicles. Private pension wealth is the value of all occupational and personal pensions, including both defined contribution and defined benefit pensions, as well as pensions in payment. Financial wealth includes the value of formal investments such as bank or building society current or savings accounts, ISAs, endowments, stocks and shares, informal savings, and children's assets, less financial liabilities. This includes shares in public and private corporations, the main source of wealth measured in the Sunday Times Rich List. Business assets, in contrast, include the value of assets used within a business in which the respondent is self-employed, or is a director or partner. This includes unincorporated businesses, and is unlikely to closely match the STRL concept of 'business wealth', which largely reflects shares in public or private corporations.

Private pension wealth can be difficult to value. Defined contribution (DC) pensions, which take the form of a pot of savings accumulated by individuals over their working lives, can be valued simply as the fund value held in the pension pot at a particular point in time, much in the same way as funds held in a savings account can be valued. Defined benefit (DB) pensions and pensions that have been annuitised are more complex. These pensions promise a guaranteed income stream from the point at which an individual retires, which for DB schemes is often based on the individual's average or final salary. The ONS calculate the value of DB pensions and pensions in payment by estimating the size of a DC pension pot that would be required to purchase an annuity with the same guaranteed income.¹⁷ For pensions not already in payment, this is discounted to give a present value using a discount rate which can vary over time in line with inflation.¹⁸ As a result, the value of DB pensions can vary over time with external economic factors even if there is no change in income provided in retirement.

There is significant heterogeneity in the types of assets held by families across the wealth distribution (see Figure 4). Poorer families tend to have very little gross property or financial wealth and are more likely to have financial debts exceeding assets than a typical family – this means that physical assets make up a much higher proportion of their overall wealth. This pattern reverses for wealthier families: net property wealth is the most important source of wealth for the fifth, sixth, seventh and eighth deciles, while physical assets make up a very small share of the total wealth for the richest families. Pension assets make up the largest source of net wealth of all asset types and is remarkably stable across the wealth distribution at the fourth decile and above. Poorer households are much less likely to have private pension wealth, likely reflecting lower capacity to save for retirement due to low income, although there is some evidence that in recent years more families across the wealth distribution now have access to defined contribution pension wealth as a result of auto-enrolment (Slaughter, 2020).

Holdings of financial and business wealth vary widely across the wealth distribution, and this is particularly the case for the very wealthiest families: 30% of wealth for the richest 10% of families comes from financial or business assets. This contrasts with just 12% of the total wealth for the next richest decile. Financial assets are both more liquid, and are not typically associated with consumption flows. It can therefore be expected that the higher prevalence of financial assets, particularly for the wealthiest 10% of families, can provide an important cushion in times

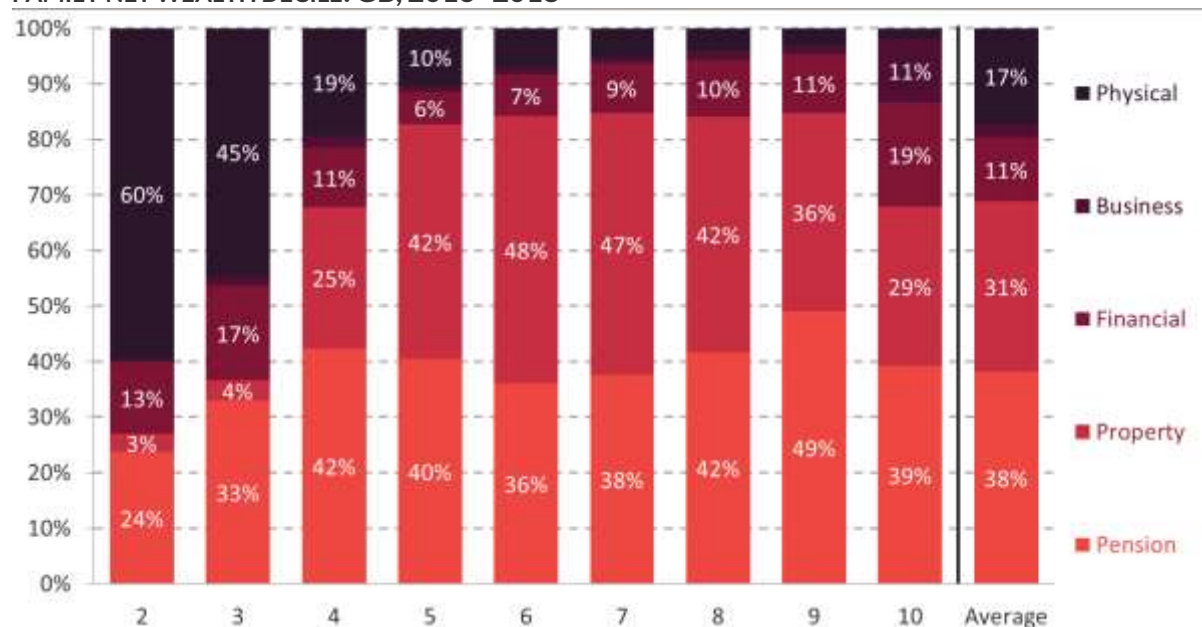
¹⁷ For the methodological details, see the Wealth and Assets Survey User Guide Round 6 (ONS).

¹⁸ The discount rate used by the ONS is the Superannuation Contributions Adjusted for Past Experience (SCAPE) rate, which is set at 3% above CPI.

of economic crisis. Liquid financial assets can be readily used to support consumption if income falls, while other asset types are much harder to convert (e.g. property) or effectively impossible (e.g. pension wealth for working age families) making liquidity constraints more problematic (Pissarides, 1978; Deaton, 1991; Attanasio, 1999, Carroll, 2001).

The types of financial asset held also varies across the wealth distribution. Poorer families hold the vast majority of their financial wealth in cash or current accounts ('Zero-return assets' in Figure 5) likely as a result of needing to use their available financial assets for liquidity. Richer households hold increasingly risky assets – which are also the types of financial assets which appreciate in value when stock and bond prices increase. But even the richest households tend to hold a significant share of their financial wealth in low-yielding and safe assets. In practice, the main way most UK families expose themselves to financial market returns is via their pension savings.

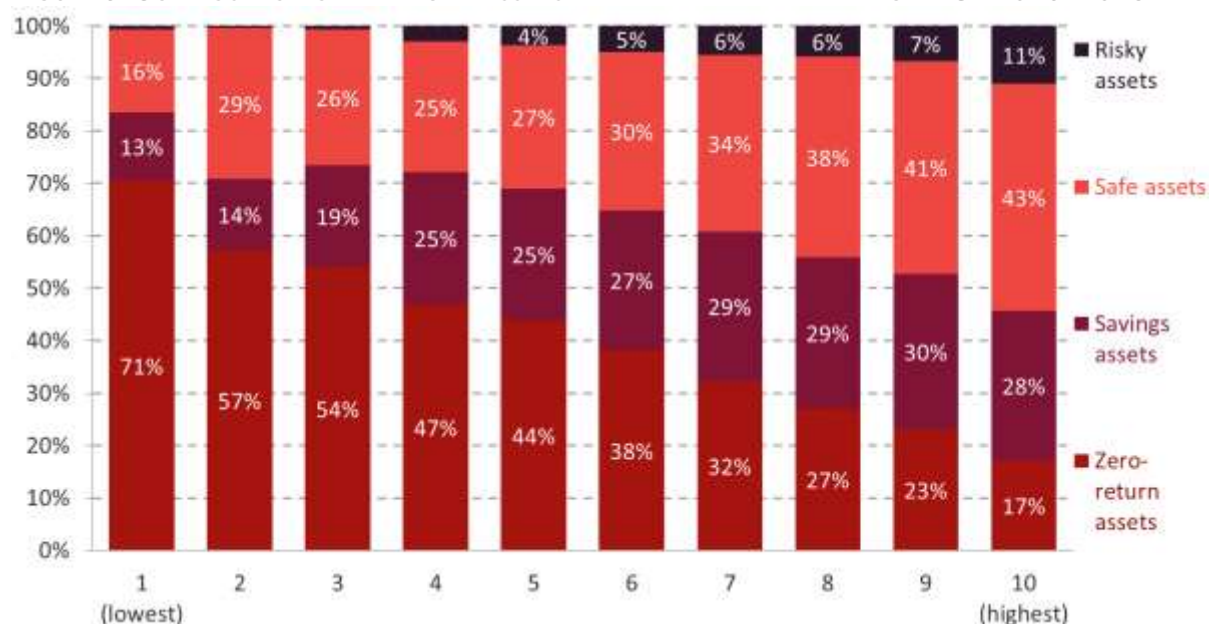
FIGURE 4: AVERAGE SHARE OF TOTAL NET WEALTH CONTRIBUTED FROM DIFFERENT ASSET CLASSES BY FAMILY NET WEALTH DECILE: GB, 2016–2018



Notes: Individuals are allocated to deciles based on wealth measured at family level. The lowest decile is excluded as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities. Figure B4 shows this graph using individuals as the unit of analysis. Figure C3 shows this graph using households as the unit of analysis. Figure D3 shows the average share of total net wealth contributed from different asset classes when main homes and pension wealth are excluded.

Source: ONS, Wealth and Assets Survey.

FIGURE 5: COMPOSITION OF FINANCIAL ASSETS BY FAMILY NET WEALTH DECILE: GB 2016–2018



Notes: Individuals are allocated to deciles based on total wealth measured at family level. Zero-return assets include cash, current accounts and other informal financial assets. Savings assets include savings accounts (i.e. interest-bearing sight deposit accounts) and national savings products. Safe assets include ISA accounts,¹⁹ saving bonds (i.e. fixed term saving accounts), unit and investment trusts, insurance products and other formal financial assets. Risky assets include domestic and overseas shares and bonds.

Source: ONS, Wealth and Assets Survey.

3.3 Changes in wealth levels

Financial Wealth

A hugely important trend for financial wealth has been the scale of the aggregate increase in its value; since 2006–08 total financial wealth in Great Britain has increased by more than 60% in real terms (from £1.4 trillion to £2.3 trillion) in current CPI-adjusted prices. This represents a remarkable increase in the wealth families hold. Bangham and Leslie (2020) and Mulheirn (2020) show that the increase in financial wealth over this period has been overwhelmingly driven by changes in asset prices rather than active saving by individuals.

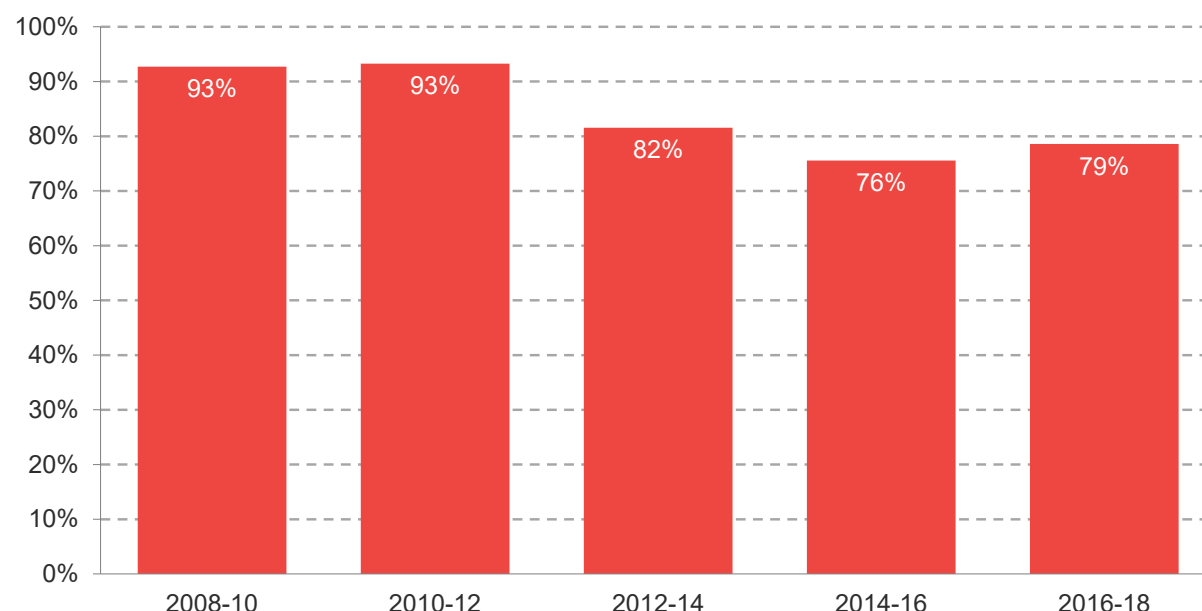
Figure 6 shows the estimated share of families' change in financial wealth as a result of changes in financial asset prices and financial market yields. This analysis exploits the longitudinal nature of the WAS. Concretely, the change in financial wealth of each family is calculated for each adjacent two-year period of the survey. A counterfactual financial wealth value is calculated by applying the average returns observed for a granular breakdown in financial asset classes over the relevant two-year period. Between 2008–10 to 2010–12, for example, 93% of the average change in families' financial wealth could be accounted for by changing asset prices and financial market yields. The remaining wealth change is the net saving of the family over this period.

This fact is important context for understanding how wealth has changed in the UK: to a large extent, wealth gains for families have accrued as a result of already holding wealth – wealth gains have been passive rather than requiring active saving. This also is important for any government considering the taxation of wealth as people are likely to feel it is more justifiable

¹⁹ This includes both cash ISAs (which would be more similar to savings assets in this taxonomy) and stocks and shares ISAs. We have included both within the 'safe assets' group because both these ISA accounts would typically have a higher yield than non-ISA savings accounts.

for a government to tax ‘unearned’ gains in wealth rather than those which come about through ‘virtuous’ action like working more or saving (Sachweh and Eicher, 2020; Rowlingson, Sood and Tu, 2020).

FIGURE 6: SHARE OF TOTAL AVERAGE GAINS IN FINANCIAL WEALTH FROM CHANGES IN ASSET PRICES: GB



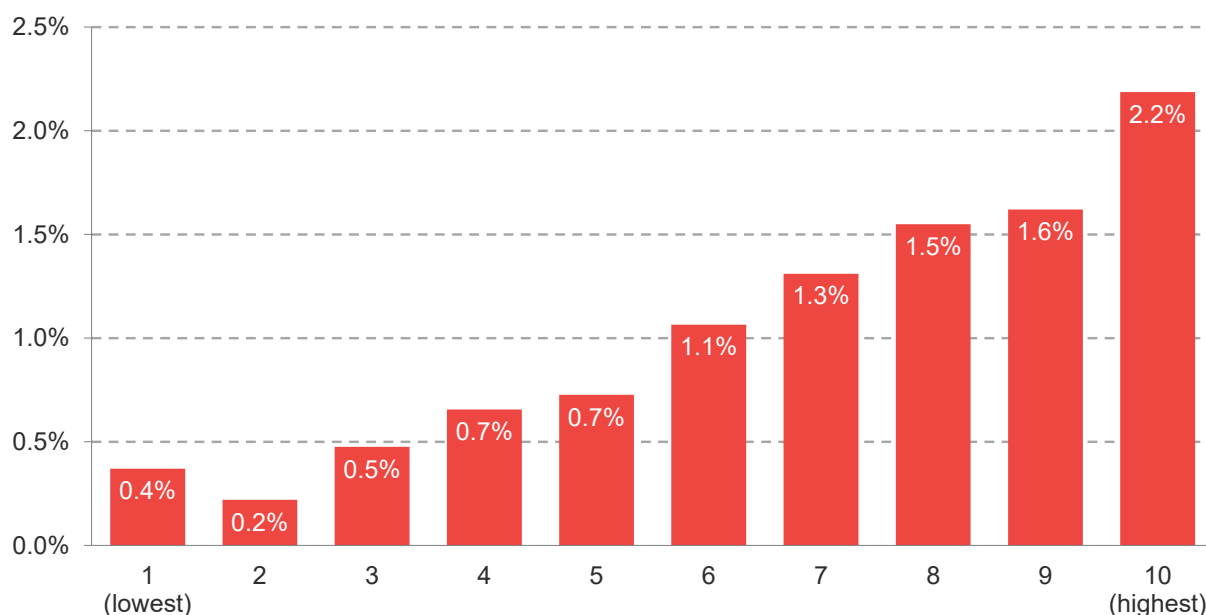
Notes: Total changes in family financial wealth is measured between each two-year sample of the WAS. This is compared to a counterfactual change in wealth predicted by average financial returns for a granular breakdown of assets. This is then used to calculate the share of the observed change in wealth that would on average have resulted from financial returns.

Source: Bangham and Leslie (2020).

Increasing financial wealth has also tended to accrue to the already wealthy. As already shown, wealthier households tend to hold financial assets which have more risk but also tend to have higher average returns. In simple terms, a household holding a portfolio of company shares will have experienced a larger increase in wealth than one who held the same wealth in a savings account which in turn had a higher return than cash (see also Bach, Calvet and Sodini, 2020; Fagereng et al., 2020). Figure 7 presents a crude estimate of this in-built acceleration of wealth inequality whereby richer households will tend to experience faster gains in wealth. This estimate is calculated as the weighted average return for the average financial portfolio for a family within each decile based on granular financial asset classes. This is not an estimate of the actual return experienced by families because real returns will diverge from the average, and this divergence may differ across the wealth distribution.²⁰ Saez and Zucman (2016) argue that divergences in returns across the wealth distribution has been one of the most important drivers in rising wealth inequality in the US over the past few decades.

²⁰ Indeed, Fagereng et al. (2020) show that richer households in Norway tended to achieve higher than average returns within asset classes. Similarly, Bach, Calvet and Sodini (2020), show that returns on wealth are highly persistent and are positively related to existing wealth levels. The estimates presented here are therefore likely to be an underestimate of the divergence between richer and poorer families.

FIGURE 7: MEAN ANNUAL FINANCIAL ASSET RETURN BASED ON DIFFERENCES IN PORTFOLIO COMPOSITION, BY FAMILY NET WEALTH DECILE: GB, 2016–2018



Notes: A family's financial return is calculated as an average of the observed average annual financial returns for a granular set of financial assets weighted by their financial asset portfolio composition. Each family's calculated financial return is average within net family total wealth deciles. This does not show the actual returns experienced by each family as this is not observed in the WAS data.

Source: Bangham and Leslie (2020).

Pension Wealth

Financial wealth is not the only category of wealth which has experienced increases in value over the past decade. Aggregate private pension wealth has also increased in value by more than 60% since 2006–2008 (ONS, 2019a). It is important to distinguish between increases in pension wealth which are driven by an increase in the value of assets held by pension funds – which can reflect both increases in pension saving as well as interest earned on invested assets – and changes in the annuity and discount rates used to calculate the present value of DB pensions and pensions in payment. The drivers of increased DC pension wealth are similar to those affecting financial wealth because the majority of assets underlying the value of pension funds are financial assets. In particular, the secular decline in interest rates around the world as central banks cut rates and conducted quantitative easing to counteract the post-financial crisis economic slowdown, has lifted the price of financial assets around the world.²¹ However, the value of DB pension wealth can fluctuate in the absence of any changes to expected income streams, as a result of economic factors which affect the discount rate and the annual income that can be bought with a pension pot of a given size.

A significant proportion of the change in pension wealth over time can be explained by changes in these external factors, rather than changes in the value of pension funds. For example, between 2014–16 and 2016–18, aggregate pension wealth increased by £0.9tn (17%), of which 81% was explained by an increase in the value of DB pensions and pensions in payment (ONS, 2019a). Of this increase, 59% was explained by changes in annuity rates and the discount rate, rather than changes in the income individuals derive, or expect to derive, from their pension. In fact, aggregate pension wealth in 2016–18 would be 32% lower if annuity/discount rates were

²¹ See Gangon et al. (2019) for more detail on the impact of quantitative easing on wealth inequality in the UK.

fixed at 2006-08 levels.²² There is an important distinction to be made between increases in wealth attributable to an increase in saving, and increases in wealth attributable to falling interest rates, as the latter has no effect on the standard of living individuals can expect to have in retirement (Mulheirn, 2020), though it does still have distributional consequences.

Over time, the annuity rate – the value used to convert a pension pot into an annual income stream – has declined.²³ This means that purchasing a given income stream has required a higher equivalent DC pension pot, and the value of DB pension wealth has therefore increased. Simultaneously, there have been changes in the discount rate used to calculate the present value of future income streams. The average discount rate used rose from 5.5% in 2006-08 to 6.8% in 2010-12, before falling to 5.2% in 2016-18. A rise in the discount rate reduces the present value of future income payments, having a negative effect on the value of DB pension wealth between 2006-08 and 2010-12, and a positive effect subsequently.

An important difference between financial wealth and pension wealth is that rises in pension wealth levels have a lower impact on relative inequality because pension wealth is held more equally across the wealth distribution.

Property Wealth

Property wealth gains have been much lower over the past decade, rising by just 14% in real terms. While interest rates falls push up property prices all else equal, and explain a large part of the rise in property values (Mulheirn, 2019; 2020; Miles and Monro, 2019), falls in mortgage rates have tended to be smaller than the falls central bank rates. Outside the South of England, real house prices have been largely flat since the pre-financial crisis peaks, limiting the gains that many families have experienced in property wealth. The relatively slow growth in property wealth is a major driver of the declining share of wealth in the middle of the distribution, as property wealth makes up a much larger share of wealth for middle-wealth families (Figure 4).

Demography

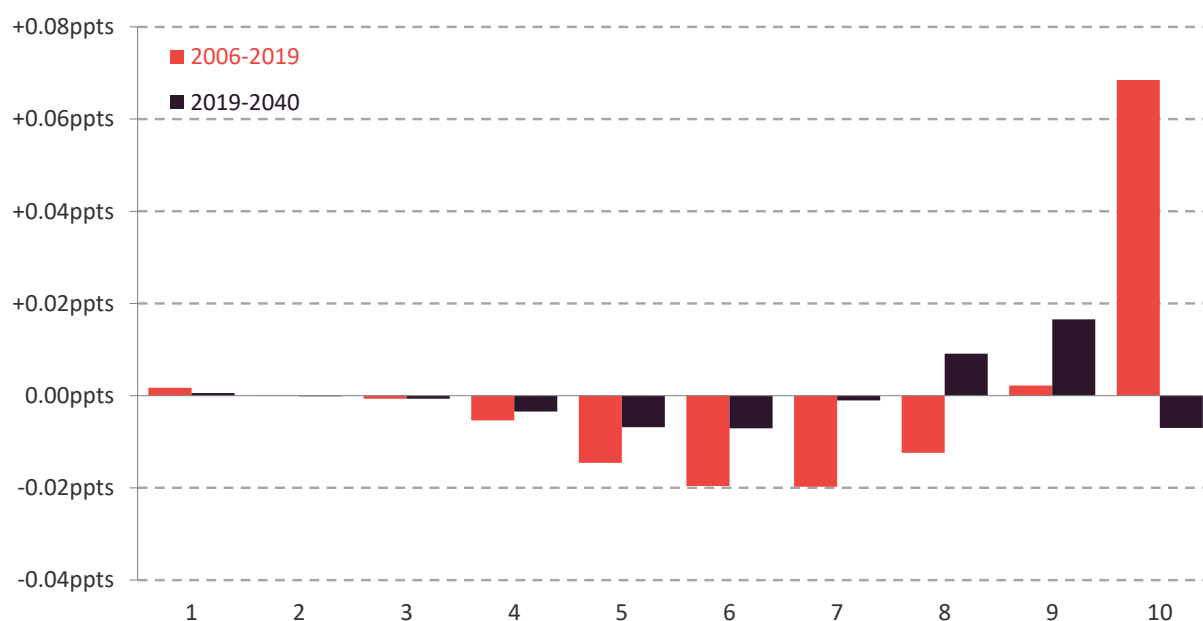
As we have shown, the major driver of the changing size and distribution of wealth has been the returns to financial and pension wealth and the (relative) lack of returns to property wealth over the past decade. But there is another potentially important factor: demographic changes – particularly the ageing population. An individual's wealth changes substantially over the course of their life, with families tending to build up wealth over working age before drawing down wealth somewhat in retirement (D'Arcy and Gardiner, 2017). The UK population has been ageing and is expected to continue to do so; between 2006 and 2019 the share of the population between 20 and 39 years old fell from 27.3% to 26.3% and is expected to fall to 24.5% by 2040 (ONS, 2019b). There has been a commensurate increase in older workers and retired people. This would naturally lead to a shift in the distribution of wealth however, as shown in Figure 8, the estimated effect of the ageing population has been small relative to the scale of the overall shift in wealth shares across the wealth distribution.

²² Authors' calculations based on user-requested data from the ONS:

[https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/pensionssavingsandinvestments/adhocs/12234privatepensionwealthforpensionwealthvaluedusingannuitydiscount ratesassumingannuitydiscount ratesfromjuly2006tojune2008andrelevantsurveyperiod](https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/pensionssavingsandinvestments/adhocs/12234privatepensionwealthforpensionwealthvaluedusingannuitydiscountratesassumingannuitydiscount ratesfromjuly2006tojune2008andrelevantsurveyperiod)

²³ An annuity rate of 0.05 implies that a £100,000 pension pot could buy annual pension payments of $0.05 \times 100,000 = £5,000$.

FIGURE 8: ESTIMATED CHANGE IN SHARE OF WEALTH FOR EACH NET FAMILY WEALTH DECILE DUE TO POPULATION AGEING: GB



Notes: These estimates are calculated by reweighting the WAS sample from 2006–2008 to match the 2019 age distribution and the 2016–2018 WAS sample to match the 2040 projected age distribution. This estimate therefore abstracts from cohort effects.

Source: ONS, Wealth and Assets survey; ONS population estimates.

3.4 Characteristics of high-wealth households

Much of the political focus on inequality in the UK and around the world focusses on the people who are at the top of the distribution. This section tries to explore the characteristics of families which could be considered high-wealth. As high-wealth is a subjective term, we use five thresholds as markers of high wealth families: families where the per adult net wealth exceeds £250,000, £500,000, £1 million, £2 million and £5 million. These thresholds broadly range from households in the top 40% of the wealth distribution to the top 1%. In practice, this analysis is also useful for understanding the characteristics of families which may be subject to plausible thresholds for a net wealth tax. As such we might also be interested in the characteristics of those with wealth above these thresholds for a more restrictive definition of wealth that could be adopted for a wealth tax; Appendix E reproduces the results below where total wealth is defined to exclude wealth from main residential properties and pensions.

Demographic characteristics

There are large differences in the probability of an individual living in a high wealth family across age and sex (Figure 9a and b). Men are more likely than women to live in high-wealth families, largely reflecting the fact that single men are more likely to be high wealth than single women.

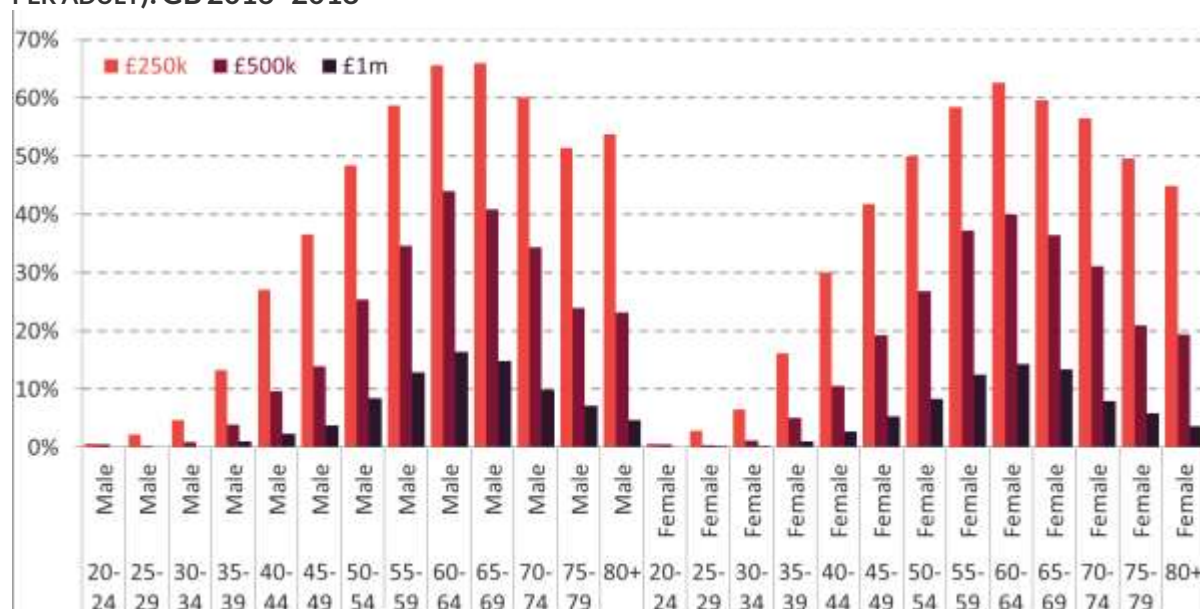
Older people are also much more likely to live in high wealth families. This is unsurprising given the strong life-cycle effects in wealth (Davies and Shorrocks, 2000). Wealth is a lifetime concept, and it is important to recognise that what is considered ‘wealthy’ may be quite different for a 20 year-old compared to someone who is middle-aged. The same level of wealth can put an individual at very different places in the wealth distribution of different age groups (Huggett, 1996). As well as a rising mean, inequality in (financial) wealth also increases with age (Deaton and Paxson, 1994; De Nardi, 2004; Storesletten et al., 2004). For example, median family wealth for a 40-44 year-old is £126,000. Having this amount of family wealth would place an individual

at the 99th percentile of the wealth distribution for a 20-24 year-old, but only the 24th percentile of the wealth distribution for a 60-64 year-old.²⁴ However, it is important to note that this variation in wealth by age reflects not only lifecycle effects, but also cohort effects whereby older generations were able to accumulate wealth at a faster rate than younger generations (Bourquin, Joyce and Sturrock, 2020).

The biggest disparity in high-wealth families by age is for those with per-adult wealth above £2 million, where families are much more likely to be late working age or early retirement. However, the pattern switches at a threshold of £5 million to having much less variation by age. This is consistent with the lifecycle consumption-smoothing motivation for savings being a less important driver of wealth accumulation and decumulation at this high level of wealth.

In Appendix F, we present additional evidence on the relationship between age and wealth, including on the geographical distribution and composition of wealth among those in the pre-retirement phase (aged 55-64), when wealth holdings are at their peak. If individuals smooth consumption over their life, then differences in this measure of wealth capture the differences in permanent consumption, which is likely to be a good proxy for welfare (Browning and Crossley, 2010; Attanasio and Weber, 2010). Differences in wealth across individuals are therefore indicative of lifetime differences in economic welfare, as wealth measured at its peak is informative of the total amount of resources available to individuals over their life-cycle. However, there is some evidence of higher savings rates among those with high levels of lifetime income (relative to those with lower levels), implying that differences in wealth at retirement might overstate differences in lifetime consumption (Dynan, Skinner and Zeldes, 2005; Bozio et al., 2017).

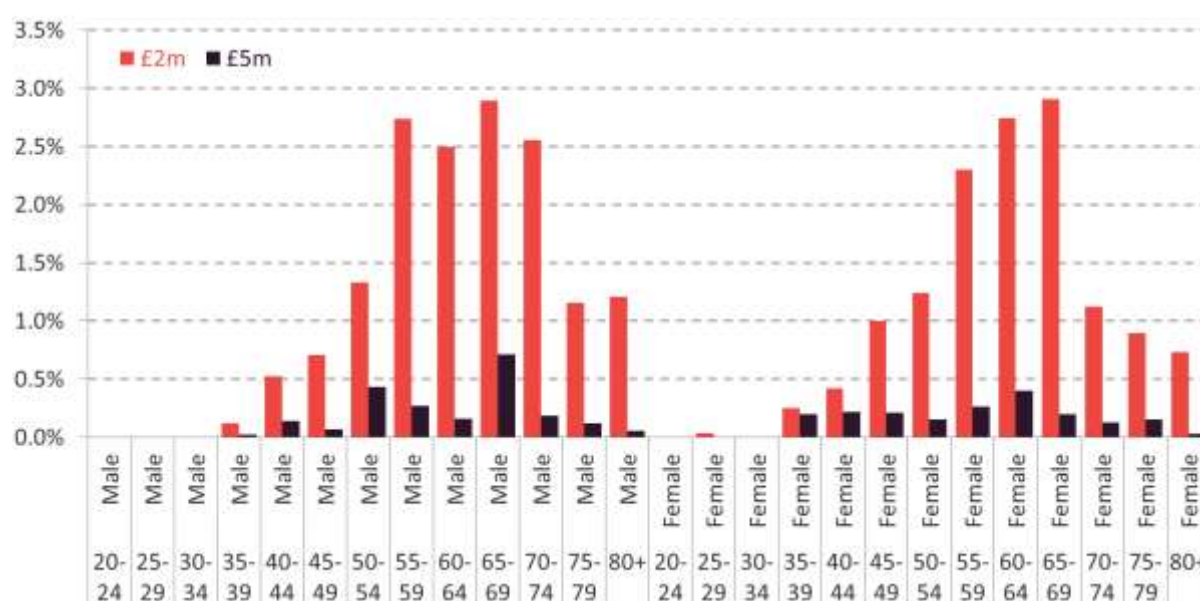
FIGURE 9A: SHARE OF AGE AND SEX GROUP THAT LIVE IN HIGH-WEALTH FAMILIES (ABOVE £250,000 PER ADULT): GB 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Figure E1 shows this graph using an alternative definition of wealth that excludes main homes and pension wealth.
Source: ONS, Wealth and Assets Survey.

²⁴ In Appendix F, we show where in the distribution of a wider range of age groups this individual would be placed.

FIGURE 9B: SHARE OF AGE AND SEX GROUP THAT LIVE IN HIGH-WEALTH FAMILIES (ABOVE £2 MILLION PER ADULT): GB 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Figure E2 shows this graph using an alternative definition of wealth that excludes main homes and pension wealth.

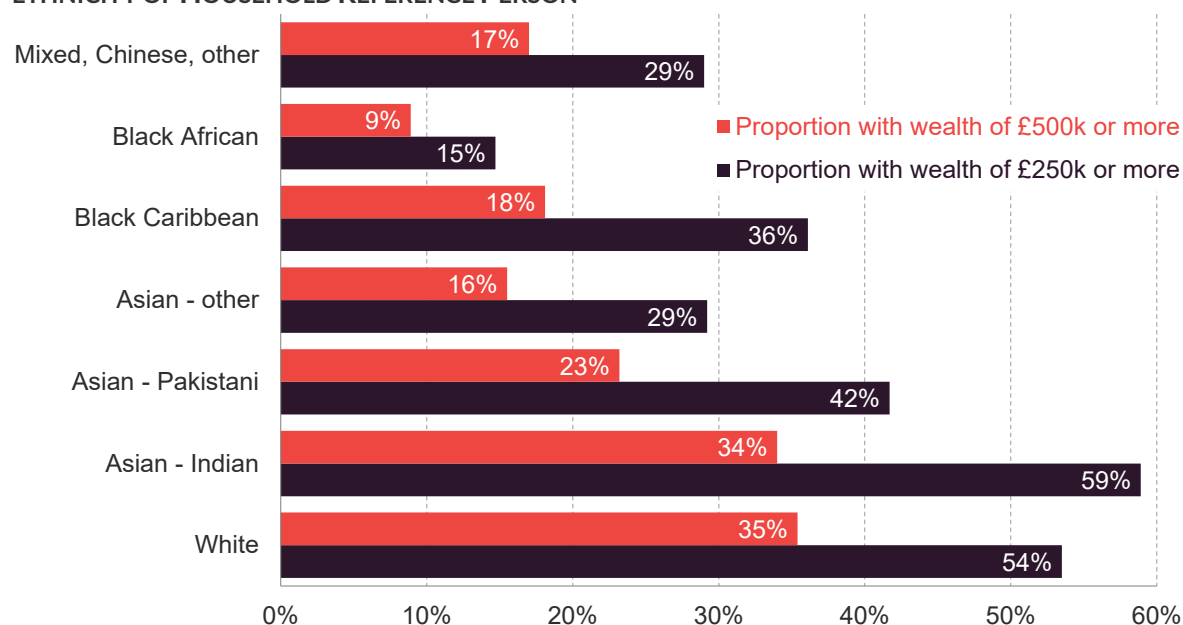
Source: ONS, Wealth and Assets Survey.

Additionally, the variation in wealth holdings between households of different ethnicities is striking, and is under-studied due to the scarcity of relevant data. Figure 10 shows the proportion of households with total net wealth above £250,000 and above £500,000.²⁵ It shows that households whose Household Reference Person is of White ethnicity are most likely to have total net wealth of £500,000 or more, closely followed by those of Indian ethnicity.²⁶ The sample size precludes us from examining all of the ethnic minority groups available in the data individually, but Figure 10 can tell us that households of Black African ethnicity are least likely to have net wealth over the £500,000 threshold, and four times less likely than those of White ethnicity.

²⁵ Sample sizes become too small to present results for higher wealth thresholds. It is also important to note that this is a different unit of analysis from the other charts in this section, as a result of needing to use a more data-secure version of the WAS dataset to conduct analysis by ethnicity.

²⁶ Ethnic group is based on the Household Reference Person's reported ethnicity – this is the survey-designated primary adult within the household. Where the individuals within a couple have different ethnicities, this will not be captured by our estimates.

FIGURE 10: SHARE OF HOUSEHOLDS ABOVE WEALTH THRESHOLDS WITHIN ETHNICITY GROUPS, BY ETHNICITY OF HOUSEHOLD REFERENCE PERSON

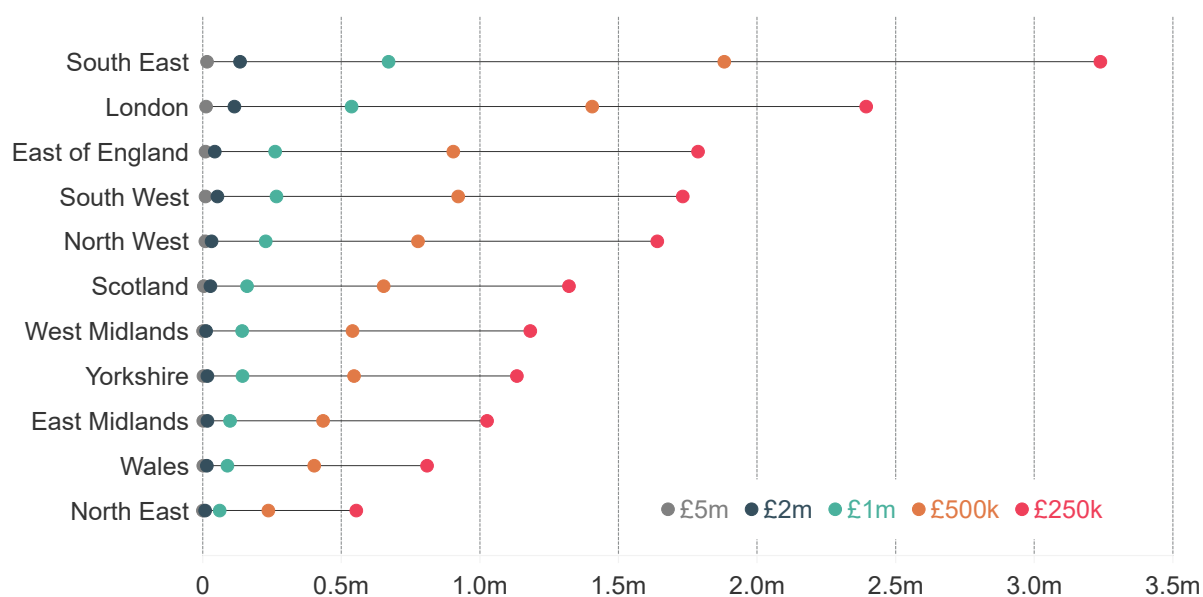


Notes: Wealth thresholds are measured as total wealth per adult within the family. Individuals reporting Chinese, Mixed and Other ethnicities are combined due to restrictions on the minimum sample size that can be analysed.
Source: Office for National Statistics, Social Survey Division. (2020). *Wealth and Assets Survey, Waves 1-5 and Rounds 5-6, 2006-2018: Secure Access*. [data collection]. 6th Edition. UK Data Service. SN: 6709. DOI: <http://doi.org/10.5255/UKDA-SN-6709-5>

Geography

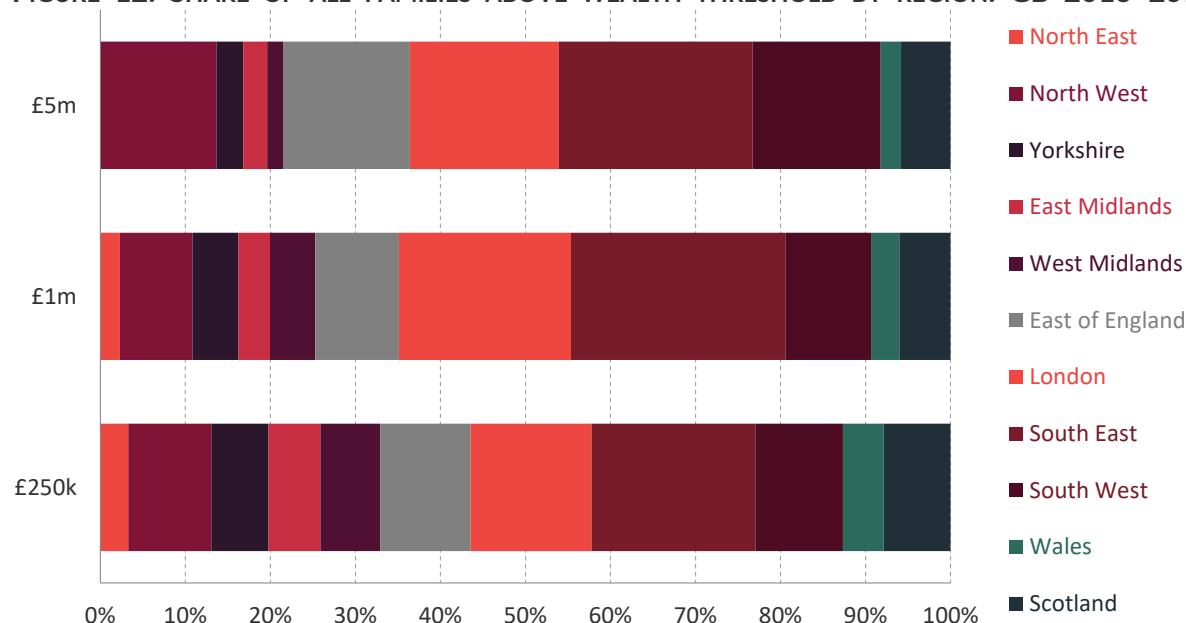
Another characteristic of interest is the geographic distribution of high wealth families. As Figure 11 shows, the South East of England has the highest number of high-wealth families, with well over 3 million adults living in families with net wealth per adult over £250,000. The North East is the region with the lowest proportion of high-wealth families. Figure 12 shows the share of the total number of families which are above the wealth threshold coming from each region. This shows that the large regional disparity in high-wealth families magnifies as the threshold increases. For example, 14% of all families with per-adult wealth above £250,000 are in London but this share rises to 24% for families with wealth above £2 million.

FIGURE 11: NUMBER OF HIGH-WEALTH INDIVIDUALS BY THRESHOLD LEVEL, CALCULATED AT THE FAMILY LEVEL: GB, 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Figure E3 shows this graph using an alternative measure of wealth which excludes main homes and pension wealth.
Source: ONS, Wealth and Assets Survey.

FIGURE 12: SHARE OF ALL FAMILIES ABOVE WEALTH THRESHOLD BY REGION: GB 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Figure E4 shows this graph using an alternative measure of wealth which excludes main homes and pension wealth.
Source: ONS, Wealth and Assets Survey.

Volatility

A natural question is how stable the group of high wealth families is over time. In other words, how frequently does a high wealth family become a lower wealth family or vice versa. As Figure 13 shows, there is relatively little churn between families lower in the wealth distribution: just 7% of families in the bottom half of the wealth distribution move into the top half over a two-year period. Around 80% of those in the top 10% in 2016-18 remained at the top

two years later, and most of the entry and exit from this group is to the next decile. We look at mobility over this relatively short time period because it best represents the possible regular change in the population of families covered by a wealth tax that we might expect. Viewing the movement of families across the wealth distribution over a longer time period results would result in higher mobility, largely reflecting life-cycle effects (as highlighted by Figures 9a and b) and intergenerational transfers (which are only partially covered by the WAS, making further analysis beyond the scope of this paper) rather than movements due to volatility in wealth holdings. However, there is more churn in wealth in the upper-middle of the wealth distribution, similar to findings of Hurst et al. (1998) in the US, where a much higher proportion of those in the ninth decile move up or down the wealth distribution, over the relatively short two-year period, than in the lower half of the wealth distribution.

FIGURE 13: PROPORTION OF FAMILIES MOVING BETWEEN WEALTH GROUPS OVER TWO YEARS



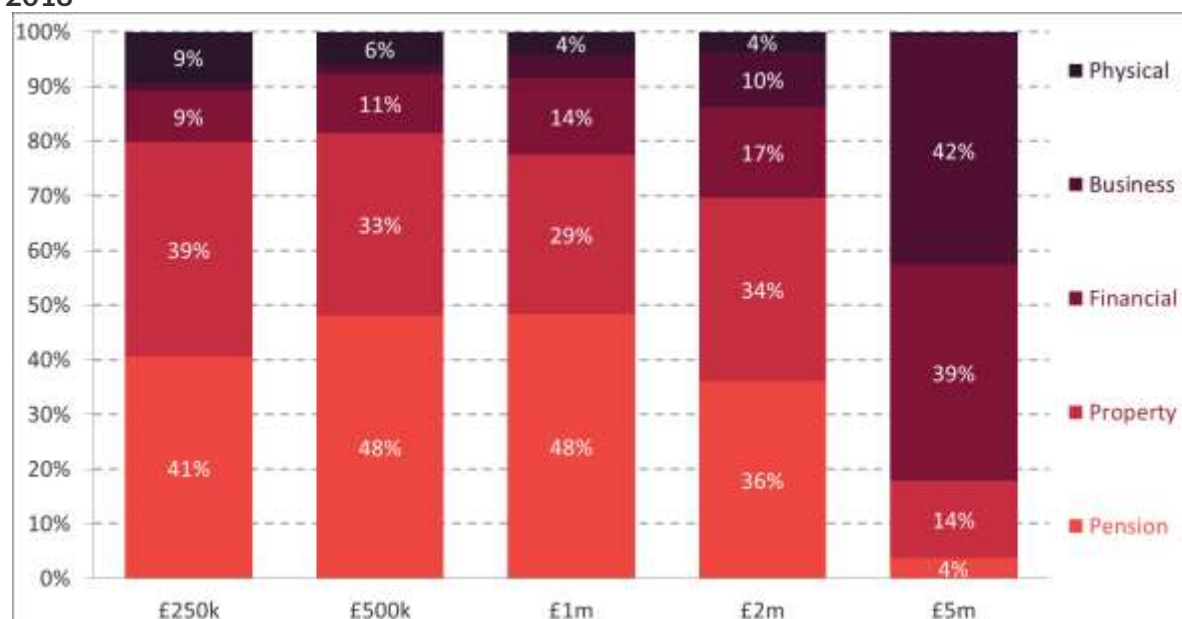
Notes: Observations for families who appear in both the 2014–2016 and 2016–2018 WAS samples are linked between the two samples. Their position in the wealth distribution is recorded in both and the share of households moving between groups is shown. The sample is weighted to account for differential sample attrition based on a probit model including observed characteristics including family type, age and education.

Source: ONS, Wealth and Assets Survey.

Asset composition

Unsurprisingly, there are big differences in the types of assets held by the average family above each wealth threshold. Figure 14 shows the average share of total assets from each broad asset class for families above each wealth threshold. There is a big step-change between families above £2 million per-adult wealth and £5 million where the relative importance of business and financial assets is much higher for the very wealthiest families. This has important implications for policymakers considering implementing a wealth tax; if the wealth tax threshold is set at a low level, the biggest sources of revenue would be property wealth and pension wealth (excluding these asset-types would reduce the tax base by 80%), in contrast, under a very high wealth tax threshold, financial and business wealth would be the most important assets for the tax base.

FIGURE 14: COMPOSITION OF NET WEALTH BY GROUPS CAPTURED BY EACH THRESHOLD: GB, 2016–2018



Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc). Figure E5 shows this graph using an alternative measure of wealth which excludes main homes and pension wealth.

Source: ONS, Wealth and Assets Survey.

4. Adjusting for data deficiencies

4.1 Adjusting for high wealth families

One of the major challenges with understanding the size and distribution of wealth, particularly in any country without a wealth tax (and so comprehensive administrative wealth data), is deficiencies in the data. Aggregate wealth measured in WAS using our preferred definition is £14.4 trillion, but this is likely to be an under-estimate of true wealth in the UK.²⁷ There are good reasons to think that wealthier households are less likely to respond to surveys such as the WAS. For example, wealthier households will tend to have more complicated set of assets and liabilities, making responding to the survey more time consuming and difficult. The incentive payments offered to engage in the survey will also be relatively less valuable to these households.²⁸ Item non-response where survey respondents fail to include some of their assets is also a source of concern. The reasons leading to lower high-wealth response rates will tend to magnify the higher up the wealth distribution a family lies. This means there is a greater chance that the very wealthiest people in the UK will not be captured by the sample leading to a significant gap in the estimated total UK wealth and how much of wealth is held at the top of the wealth distribution.

In order to explore the size of the potential under-coverage of high-wealth in the WAS, we turn to the best available summary of the wealthiest families in the UK – the Sunday Times Rich List (STRL). This is an annual publication which attempts to identify the 1,000 richest people or families that predominately live or work in the UK (we turn to the issues of primary address, citizenship and tax residency location later). The data is compiled in such a way so as to represent a plausible lower-bound estimate of each family's wealth (Watts, 2020) – and amounts to a total wealth value of £700 billion. The STRL takes a cautious approach to valuing wealth in a number of ways. First, not all assets are included – data is primarily based on private and public business assets as well as known land holdings and other items (such as art holdings). Private financial assets (excluding shares) will largely not be captured as there is no available data in order to base their wealth estimates. Given the composition of assets highlighted for the wealthiest observations in the WAS, this suggests that there could be significant additional wealth not captured by the STRL. There is also some risk that individuals who keep their wealth private, by holding wealth via trusts for example, may be excluded from the list. Second, owners of companies known to have high levels of debt or negative profits are excluded from the list, in order to limit the over-estimation of wealth through the under-estimation of liabilities. Third, private businesses are valued at a relatively low multiple of earnings (10 to 12 times recent earnings compared to 20 times for FTSE 250 companies).

Combining the WAS with the 2017 and 2018 editions of the STRL – which provide the best chronological overlap with the 2016-18 WAS interview period – we see that the top wealth observations in the WAS sample overlap with the STRL; the WAS includes observations for two households with wealth above £100 million.²⁹ This suggests that the WAS is managing to sample some households at the very top of the UK's wealth distribution. In fact, when accounting for the weighting of households in the WAS which overlap with the STRL, it appears that the WAS

²⁷ The official estimate of total wealth in the UK produced by the ONS is £14.6 trillion, but they use a different definition which excludes business wealth and uses the full replacement cost for physical wealth (rather than our estimated current value based on taking 25% of the replacement cost).

²⁸ The ONS provide an 'incentive' payment of between £10 and £15 worth of vouchers for each survey.

²⁹ The most recent version of the publicly available version of the WAS microdata censors some observations to ensure that the data does not disclose details about individual families.

roughly captures the correct number of households above the minimum threshold to be in the STRL.

Despite the coverage of high-wealth families in the WAS, it is likely that it is not fully capturing total household wealth in the UK. This is because the very wealthy observations in the WAS are not fully representative of the wealth of those captured by the STRL. Indeed, the weighted total wealth of these two top households is just under £300 billion, compared to £700 billion in the STRL. This implies that at a minimum, the WAS underestimates wealth at the top by £400 billion. This is because the very wealthy observations in the WAS do not span the range of the STRL distribution: given the wide range of wealth values in the STRL, the WAS observations that do overlap with the top have wealth levels far below the top of the STRL. In addition, it is likely the wealthiest families have large variations in the composition of their assets: the WAS observations may not be representative of ‘typical’ top-wealth families.

4.2 Pareto distribution

Approach

The analysis presented so far is only indicative of the minimum size of the potential missing wealth. In order to fully estimate the value of missing wealth we follow the approach set out by Vermeulen (2018), who fits a Pareto distribution to the top tail of the wealth distribution.³⁰ The intuition is as follows. Theory tells us that the top tail of the (true) wealth distribution is likely to follow a Pareto distribution (Jones, 2015; Benhabib and Bisin, 2018), but does not specify the key parameters. The observed distribution of wealth departs from the true distribution because of the under-coverage of wealth in the survey data. However, by combining this with information contained in the Sunday Times Rich List, and the assumption that the true distribution is Pareto, we can estimate the index parameter (see below) and hence recover information about the wealth that is ‘missing’ from the survey.

Precisely, the assumption that the top tail of the wealth distribution follows a Pareto distribution indicates that it has a complementary cumulative distribution function (CCDF) with the following functional form:

$$P(W > w) = \left(\frac{w_{min}}{w}\right)^\alpha$$

defined over $[w_{min}, \infty)$, where w_{min} is the Pareto threshold (the lowest value of wealth above which a Pareto distribution holds), and $\alpha > 0$ is the Pareto index which determines the exact shape of the distribution. This implies that the share of households with wealth above a certain threshold, w , will be proportional to that threshold raised to a power.³¹ In finite populations, the proportion of households with wealth above some level, w , is constructed as the number of households with wealth above w , $N(w)$, divided by the total number of households above the Pareto threshold, N . The data are therefore consistent with a Pareto distribution if:

$$\frac{N(w_i)}{N} \approx \left(\frac{w_{min}}{w_i}\right)^\alpha \quad \forall w_i$$

³⁰ Bach, Thiemann and Zucco (2019) also follow a similar approach using the Household Finance and Consumption Survey for France, Germany and Spain.

³¹ Hence the Pareto distribution is also known as a power-law probability distribution. See Jones (2015) for a full explanation of the mathematical form of the Pareto distribution and its relationship to the wealth distribution.

where w_i denotes the wealth of a sample observation, i .

Taking logs of both sides, we see that the power law relationship implied by a Pareto distribution entails a linear relationship between the log wealth of a household, and the log of their rank in the distribution. Visually, when a household's rank in the wealth distribution is plotted against their wealth in log-log space, the data points should be approximated by a straight line. Figure 15 show this property holds in our combined WAS-STRL data. This empirical verification that wealth follows a Pareto distribution (as theory suggests) has been provided in a number of other contexts (Levy and Solomon, 1997; Davies and Shorrocks, 2000; Kopczuk and Saez, 2004; Klass et al., 2006; Ogwang, 2011; Bach, Thiemann and Zucco, 2019), including for the UK (Vermeulen, 2018). What is new here, as we describe below, are the precise data and methods we use, which we argue provide a more accurate picture of wealth in the UK.

Assuming the Pareto law holds in the UK wealth distribution, we can estimate the exact shape of the distribution – governed by the value of α – using our data. The Pareto distribution implies that as you move up the wealth distribution, the density of households declines at a specific rate. If there is substantial under-coverage at the top of the survey data, the density of households will decline faster than it should according to the underlying Pareto distribution. The STRL data provide additional observations of high-wealth households, which we can use to update our estimate of the specific rate at which the density of households should decline, and hence the shape of the underlying distribution.

Since the relationship we are interested in is linear (in logs), we can estimate α as the coefficient on log wealth from an OLS regression. Vermeulen (2018) proposes a method for estimating Pareto distributions using survey weights, and uses this to fit a Pareto distribution to Wave 2 (2008-10) of the WAS combined with data from the Forbes billionaires list. We replicate this approach, using updated data from the WAS (Round 6, 2016-18) combined with the STRL for 2020. The aim in Vermeulen (2018) is to compare fitted distributions for a number of countries, whereas our goal is to produce the most accurate estimate of the distribution for the UK specifically. The STRL is therefore preferable as a data source, provides much richer information on the top tail of the UK wealth distribution with 1000 observations, while the Forbes billionaires list only includes 41 UK residents in 2020.

We estimate the Pareto distribution using a combined sample of the WAS and the STRL. In constructing this sample, we remove the two WAS households that overlap with the STRL, to avoid double counting this wealth. We do not re-weight the data to account for the inclusion of the STRL. This is because the combined weight of the two omitted households is roughly equivalent to the number of STRL observations – which we assume each represent one household,³² and so this adjustment has very little effect on the overall population total.

In fitting a distribution to this combined sample, a necessary assumption is that households in the STRL are drawn from the same underlying wealth distribution as households in the WAS. This requires that (i) wealth be measured using a common definition in both data sources, and (ii) that there is a consistent measure of 'units' who hold this wealth. However, without adjustment this is not the case. First, the asset classes covered are different: the WAS data provide a comprehensive account of all assets and liabilities while the STRL is primarily based on business assets with some additional assets added where available. Second, the STRL observations are taken at a broad family level, and this often includes more than two adults and their dependent children (the definition of family used in our WAS analysis). For example, in the

³² As we combine two waves of the STRL, we assign each entry a weight of 0.5.

2020 rich list, the Barclay brothers are listed jointly at 17th, but were they to be part of the WAS survey, they would be treated as separate households.

To address the first issue, we create a measure of wealth in the WAS which most closely relates to the coverage of assets in the STRL. Specifically, we combine private business assets with domestic and foreign shares as well as non-savings bonds, which are recorded as financial wealth in the WAS. This approach will be imperfect because the publicly available information upon which the STRL is based will not capture this exact definition of wealth for all observations. Appendix G provides results based on alternative definitions of wealth as a robustness check. In reconciling the definitions in this way, we differ from Vermeulen (2018) who, as far as we know, fits a distribution based on total wealth in the WAS. We argue that a Pareto distribution provides a closer fit to the top tail of the wealth distribution after reconciling these definitional differences. This can be seen visually by comparing Figure 15 – where the data points can be approximated by a straight line – with Figure G2 in Appendix G which uses total wealth for individuals in the WAS.

To address the second issue of differences in units, we use WAS data at the household level (rather than the family level as with previous analysis). While there is relatively little empirical difference between the data aggregated at a family and household level (particularly at the top of the distribution where households are less likely to include multiple adults outside of couples), the maximal definition of the unit of analysis used by the STRL will be best approximated, albeit imperfectly with household data from the WAS.

The OLS regression used to estimate the exact shape of the Pareto distribution is as follows:

$$\ln\left(\left(i - \frac{1}{2}\right)\frac{\overline{N}_{fi}}{\overline{N}}\right) = C - \alpha \ln(w_i) + \varepsilon_i$$

where i denotes the i th household in the combined WAS-STRL sample, when households are ranked in descending wealth order; \overline{N}_{fi} is the average sample weight of the first i households (all households with wealth above household i); \overline{N} is the average sample weight of all households above the Pareto thresholds; w_i is the wealth of household i , and ε_i is an error term. The $-\frac{1}{2}$ adjustment to the rank is based on Gabaix and Ibragimov (2011), who show this reduces the bias in OLS estimation of the Pareto index. See Vermeulen (2018, equation 10) for a full derivation of the above equation.

Estimated ‘missing’ wealth

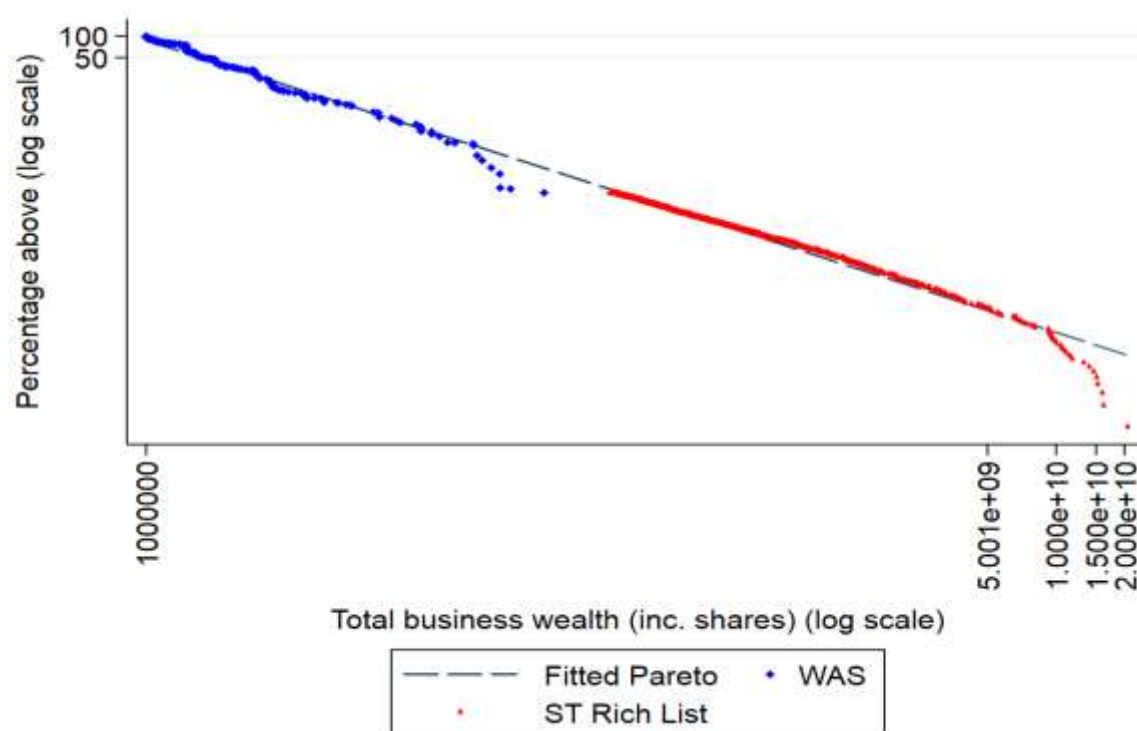
Figure 15 shows the fitted Pareto distribution using our definition of business wealth from the WAS combined with the STRL, for observations with total business wealth above £1m. We take £1m as the threshold above which a Pareto distribution applies. In practice, the estimated Pareto distribution is not particularly sensitive to the choice of threshold, which we show in Table G1. It is clear that a straight line approximates the relationship between household wealth and rank in the distribution well in log-log space, suggesting a Pareto distribution holds.

We can calculate the total value of wealth held in the top tail based on the predicted wealth of individuals along the fitted Pareto distribution.³³ After updating our estimate of wealth held above the Pareto threshold, we can add this to total wealth below the threshold to update our estimate of total wealth in the UK. Doing so suggests that the combined STRL and WAS

³³ For further detail on the method used to calculate total wealth see Appendix G.

observations modestly underestimate aggregate household wealth by around £360 billion. That is, after adding wealth in the STRL that is not captured in the WAS to the total, aggregate wealth is underestimated by around 2.4%. Adding wealth captured in the STRL and the additional Pareto adjustment to total wealth captured in the WAS increases estimated total wealth by 5%, just over half of which comes from incorporating the STRL alone. It is important to note that this does not necessarily imply that families at the top of these samples have more wealth than is reported; it might just as well be that there are more wealthy families higher up the top tail who are not being recorded in the data.

FIGURE 15: ESTIMATED PARETO DISTRIBUTION USING WAS BUSINESS ASSETS AND THE STRL



Source ONS, Wealth and Assets Survey; Sunday Times Rich List.

Implications of adjusting wealth

It is impossible to reproduce the earlier descriptive analysis of household wealth after making the adjustments suggested by the Pareto estimates. This is because the STRL data available to us does not include detailed information on the characteristics of the family members, nor does it provide a breakdown of asset types. Nevertheless, the high-wealth observations from the WAS and the STRL data suggest that very high-wealth families hold a much higher proportion of their wealth in the form of private business assets and financial wealth (this is by construction in the STRL). Figure 16 presents indicative estimates of the composition of wealth if we assume that the additional wealth from the STRL and the Pareto adjustment fall completely within the financial and business categories – this is obviously a simplification but demonstrates that were surveys to fully capture wealth in the UK, the importance of financial and business assets could be significantly higher than is currently thought.

Similarly, the indicative additional wealth total estimated here would substantially alter our understanding of the level of wealth inequality. Taking our updated estimate of additional, unobserved wealth in the top tail from the previous section, we can allocate this to the top 10% (and 1%) of the wealth distribution, since all households with business wealth plus shares in

excess of the £1m Pareto threshold are in the top 1% of the overall wealth distribution. Returning to the measure used at the start of this paper, Figure 17 provides an adjusted estimate of the shares of wealth held by the wealthiest 10% and 1% respectively. Adjusted estimates suggest very substantial increases in the share of wealth at the top of the distribution; the estimated share of wealth held by the top 10% rises from 51% to 55% and the top 1% share rises from 18% to 23%.³⁴

This corrected top share of 23% for the top 1% is significantly higher than the 14-18% estimated in Vermeulen (2018). There are two key reasons for this. First, our wealth definition includes business assets and adjusts the value of physical wealth, both of which depart from the standard WAS definition of wealth (see Section 2.4). As a result, our survey estimates of top shares are higher than Vermeulen before augmentation and Pareto adjustment. A comparison of the unadjusted top 1% share for Wave 2 (2008-10) gives 19% using our wealth definition and 13% for Vermeulen (2018).

Second, in our preferred specification we fit a Pareto distribution to business wealth, rather than total wealth. This reconciles the wealth definition used across the WAS and STRL, which is necessary to meet the Pareto assumption that the observed wealth across samples is drawn from the same distribution. Doing this gives lower estimates of the Pareto index, α , and hence higher levels of missing wealth than if total wealth is used for the WAS observations (see Table G1). The additional wealth from using the STRL and our Pareto adjustment adds around 5pp to the top 1% share in our estimates. This is similar to the upper estimate of added wealth from the Forbes Rich List and Pareto adjustment in Vermeulen (2018), though five times the lower end (1pp) estimate in that paper.

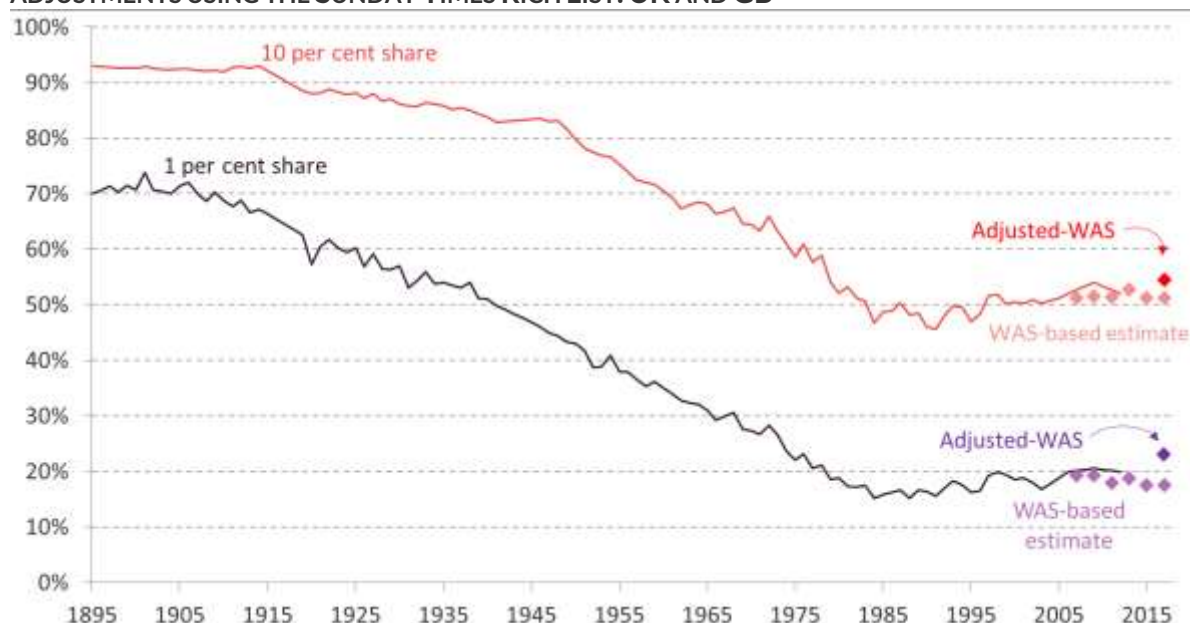
FIGURE 16: COMPOSITION OF WEALTH IN THE UK AND INDICATIVE ESTIMATES BASED ON INCLUDING STRL DATA AND A TOP-DOWN PARETO DISTRIBUTION-IMPLIED ADJUSTMENT



Notes: The additional wealth in from the STRL and that implied by a fitted Pareto distribution (for WAS and STRL observations above £1 million in business wealth) are assumed to be additional financial and business assets.
Source ONS, Wealth and Assets Survey; Sunday Times Rich List.

³⁴ It is possible that wealth is systematically under-reported across the wealth distribution in the WAS, however there is limited evidence upon which to draw to investigate that possibility – hence the focus in this paper on the top of the distribution.

FIGURE 17: SHARE OF NET PERSONAL WEALTH HELD BY RICHEST 1% AND 10%, INCLUDING ADJUSTMENTS USING THE SUNDAY TIMES RICH LIST: UK AND GB



Notes: World inequality database estimates refer to the whole of the UK and the WAS-based estimates exclude Northern Ireland. Due to changes in the coverage of business assets between survey rounds in the WAS, these results are adjusted using the latest observation of private business wealth shares held by the top 10% and 1% in the most recent round of the survey (2016-18) and imputed backwards to provide a consistent estimate. The adjusted WAS estimates add in the total wealth held by families covered by the Sunday Times Rich List as well as the upper estimate from the fitted Pareto distribution. The definition of wealth used for the long-run estimates is not consistent with that from the WAS; Appendix A provides alternative estimates of top wealth shares which address some of these differences.

Source: Alvaredo, Atkinson and Morelli, 2018, obtained from the World Inequality Database, 2020; ONS, Wealth and Assets Survey.

4.3 Other data deficiencies

Private business wealth

There are other deficiencies with the data that are available which could have a material impact on our understanding of household wealth in the UK. Perhaps the most significant of these is the measurement of private business wealth. As shown in Section 3, business assets are a relatively small part of household wealth for the vast majority of households only becoming a material component for the wealthiest 10% of households. Private business assets make up a relatively small part of the WAS questionnaire and there is some evidence that there could be under-coverage of private business wealth.³⁵

A large challenge with collecting data on private business wealth is that, in many cases, there will not be an obvious market price for the business. The WAS asks respondents who own or partially own a business to value what their share is worth were they to sell the business. There is likely to be an element of error, although due to very limited information in the WAS about the business (e.g. detailed balance sheets and revenue data are unavailable) it is impossible to

³⁵ It is our view that the structure of the survey could lead to misclassification of assets or double counting of assets for some families. For example, some households may consider particular business assets to be personal wealth – for example a plumber could report their van as a personal car only, and so not report it as a business asset (having reported it as a personal one), or may report it again as part of the value of their business, creating double counting.

derive alternative estimates of business value. Roughly half of respondents to the survey who said they owned or partially owned a business also said that the market value of the business was zero. While it is likely that a significant number of businesses, particularly sole operators, will have minimal resale value it seems implausible that half of all business have no net value.

There is also evidence that the coverage of businesses in the WAS falls below the total population of businesses in the UK. Figure 18 shows the WAS-implied number of businesses by size of business matched to estimates derived from Business Population Estimates from Department for Business, Energy & Industrial Strategy (2017).³⁶ There appears to be a systematic undercount of the total businesses we might expect and this is true across the size of businesses – the undercount equates to around 25% of the total business population. A crude scaling of those business assets which are observed in the WAS, suggests that full coverage of businesses would lead to an additional £175 million of household wealth.³⁷ The scale of this undercount is relatively small compared to that suggested by previous analysis and would not materially change our understanding of household wealth.

FIGURE 18: ESTIMATED NUMBER OF UK BUSINESSES BY NUMBER OF EMPLOYEES EMPLOYED BY THE BUSINESS: GB



Source ONS, Wealth and Assets Survey (2016–18); Department for Business, Energy & Industrial Strategy, Business Population Estimate (2017).

Housing wealth

While business wealth is under-estimated in the WAS, housing wealth appears to be over-estimated relative to external data sources such as the Nationwide, ONS, and Halifax house price indices, and the national accounts.³⁸ Average house prices were £76,000 higher in the WAS than in these house price indices in 2014–16. It is not clear why people should be overly optimistic to such an extent, though the WAS does not appear to be the only survey affected by this (see Hillyard, Patsios and Feely, 2014, for evidence of a similar pattern in Northern Ireland).

³⁶ The business population estimates are for Great Britain and have been adjusted to match the WAS definition of business (e.g. excluding non-profits and public sector corporations) as closely as possible.

³⁷ It is likely that some of the 'missing' businesses are owned by individuals in the STRL and so adding those families would already account for some of this gap.

³⁸ See ONS (2018) for more details on the difference between measures of wealth in WAS and in other data sources. In Appendix A, we compare components of wealth, including housing, between the WAS and the national accounts.

It is possible that this bias could change through the economic cycle. In Appendix A, we consider how rescaling housing wealth to match these external figures affects our estimates of the wealth distribution.

Residency and citizenship

The final material gap in our understanding of wealth in the UK comes from a lack of data on the residency, citizenship, and tax status of the individuals covered by the WAS and STRL. The WAS sampling methodology is based on addresses in Great Britain which means that for an individual to be included they just need to live at an address in Great Britain for at least some of the time. The STRL criteria for inclusion are based on having a material connection to the UK – for example, Richard Branson, fortieth in the 2020 Rich List, is not a permanent UK resident or UK domiciliary but does have businesses that operate in the UK. This has particular relevance for policymakers considering introducing wealth taxes: some of the wealth that is captured by both the WAS and the STRL will be held by people who are not UK tax residents and therefore could fall out of scope of any tax base. Conversely, WAS underestimates housing wealth held by non-residents and rented out: while the property is included in the sampling frame, and the renters who live in it are within the scope of the survey, these renters would not report the property wealth since it is not theirs.

5. Conclusion

This paper describes what we know about UK wealth as well as acknowledging what we do not know. A few facts are apparent from our analysis. Household wealth has grown in the UK and is very unequally held. These trends have been particularly stark since the financial crisis. Much of the gains in household wealth have been in rising financial asset prices (with associated increased in pension wealth) leading to a small shift in wealth shares towards the top of the wealth distribution. For those households who have become richer over the past decade, most of these gains were not as a result of active saving, rather passive accumulation in the value of wealth for those families who were already lucky enough to be well-off. This has profound implications for any policymaker thinking of introducing a net wealth tax in the wake of the coronavirus crisis.

While we can say a lot about wealth in the UK, there remains significant uncertainty over the true scale of wealth in the UK. Survey measures of wealth appear to be under-capturing wealth significantly – by as much as 7% according to our preferred estimate. This missing wealth is likely to be as a result of underreported business and financial assets.

More work is needed on data and analysis to properly understand and account for the scale of household wealth in the UK. The past decade has seen wealth levels rise remarkably as interest rates have fallen. The current economic crisis suggests interest rates are unlikely to revert to the average levels seen in the second half of the twentieth century. This means policymakers need to grapple with the now embedded gaps between richer and poorer households. A good starting point would be to improve our understanding of wealth in the UK with redoubled government efforts to fully measure it.

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Appendix A: Comparing WAS to other datasets

Comparing total wealth

The ONS official estimate of total wealth in Great Britain 2016–18 is £14.6 trillion. Using our definition of wealth, which includes business assets and adjusts the value of physical wealth, we estimate total wealth in the WAS at £14.4 trillion. Our concern is that this misses some wealth at the top, primarily due to survey under-coverage. In Section 4 we describe our method for estimating this missing wealth by adding in wealth captured in the Sunday Times Rich List, and using a Pareto adjustment to impute any additional missing wealth. After adjusting for missing wealth, we estimate total wealth at £15.1 trillion.

These estimates are considerably higher than in external data sources. In the national accounts, personal sector net worth is just £10.0 trillion in 2017. Alvaredo, Atkinson and Morelli (2018), who estimate total wealth based on inheritance tax data, find £5.5 trillion of UK wealth in 2012. Extrapolating this forward to 2017 using annual growth in personal sector net worth from the national accounts gives a total of £7.6 trillion in 2017. These discrepancies reflect differences in what is included and how this is measured. Table 1 compares each wealth component in our total with the corresponding component in the national accounts, though conceptual differences make such a comparison extremely difficult. The exclusion of physical wealth in the national accounts explains only a small proportion of the difference. Property wealth is around £1.2 trillion higher in the WAS relative to the national accounts, consistent with the finding that the WAS overestimates housing wealth relative to external house price indices (see Section 4.3). Below, we consider what happens to our standard and Pareto-adjusted estimates of total wealth and top shares when gross housing wealth is rescaled to correct for this over-estimation.

The largest discrepancy between our estimates and the national accounts is in pension wealth, which is over £2 trillion higher in the WAS than in the national accounts. This is despite the fact that ‘pension wealth’ in the national accounts also includes the value of life insurance policies, which are a component of financial wealth in the WAS. In part, this discrepancy reflects differences in the types of pension included. The national accounts exclude unfunded defined benefit pensions paid by general government (including civil service pensions, for instance). However, this cannot fully explain the difference, as supplementary estimates indicate that these pensions were worth only £1.2 trillion in 2018.³⁹ A possible explanation for the variation is the different methods used to compute the value of Defined Benefit pensions and pensions in payment, which are much harder to value than wealth held in defined contribution pensions (see Section 3.3). The formulae used for valuing these types of pension in the WAS is highly sensitive to changes in annuity rates, which have fallen significantly since the Financial Crisis. This has increased the value of pensions relative to the national accounts, where current annuity rates are just one input into a more detailed and comprehensive valuation procedure.

Excluding pension wealth from both data sources reduces our WAS total (before Pareto adjustment) to £8.3 trillion, and the national accounts total to £6.3 trillion. This is much closer to the estimate in Alvaredo, Atkinson and Morelli (2018), which excludes pension wealth. Below, we consider how our top share estimates compare to Alvaredo, Atkinson and Morelli (2018) when we exclude pension wealth from our definition.

³⁹ For more details on the pension wealth sources included in the core national accounts and supplementary estimates of excluded pension wealth see <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/pensionsinthenationalaccountsfullerpictureoftheuksfundedandunfundedpensionobligations/2018>

TABLE 1 TOTAL WEALTH IN THE WAS AND THE NATIONAL ACCOUNTS, £ TRILLION

	WAS total (our definition)	Pareto-adjusted WAS	National Accounts
Total	14.4	15.1	10.0
Property wealth (net)	5.1	5.1	3.9
Pension wealth	6.1	6.1	3.7
Financial wealth (net)	1.7	1.7	2.4
Business wealth	1.0	1.0	0.04
Physical wealth	0.5	0.5	N.A.
Net STRL adjustment (add wealth captured in the STRL but not in the WAS)	N.A.	0.4	
Pareto adjustment	N.A.	0.4	N.A.

Notes: This table does not offer a full reconciliation of national accounts concepts with the WAS, as this is beyond the scope of this work. Our definition of ‘business wealth’ in the national accounts includes machinery and equipment, cultivated biological resources, intellectual property products, and inventories owned by unincorporated businesses that are not used for final consumption by households. This excludes assets held by incorporated businesses, the value of which are recorded in the household balance sheet as equities, and are included in financial wealth. Pension wealth in the national accounts also includes the value of insurance schemes, which are included under financial wealth in the WAS. In this table, we do not take a stance on how STRL wealth and additional Pareto wealth should be allocated across different asset classes. In Figure 16, we illustrate what the composition of wealth might look like if we assume all STRL and Pareto wealth reflects financial and business wealth.

Source: ONS, Wealth and Assets Survey, Sunday Times Rich List, UK National Accounts.

A natural question to ask is, if total wealth in the WAS is already higher than in the national accounts after reconciling some of the obvious differences, what is this ‘missing wealth’ that we are allocating in our Pareto adjustment? Conceptual and methodological differences between the national accounts and survey data are endless, and reconciling these to understand how the figures compare when we actually compare like-for-like is an important task for future research. In the absence of such a reconciliation, it is possible that the missing wealth at the top that we estimate in our Pareto adjustment is indeed captured in the national accounts, but that the WAS also measures sources of household wealth that the national accounts is not trying to capture, or uses valuation methods which produce alternative, higher measures of household wealth.

We do not believe that the national accounts tell us the ‘true’ value of wealth that we would expect to find in the absence of any under-reporting or under-coverage using our WAS-based definition of wealth. Our WAS-based wealth total is, in fact, higher than total wealth as measured and defined in the national accounts. As a result, we have not taken the approach used by Credit Suisse (Davies, Lluberas and Shorrocks, 2019), who fit a Pareto distribution to the top tail but rescale total adjusted wealth to target the national accounts total. Nor do we attempt to match an external total for business wealth when adjusting on this measure, since no comparable total exists. Since the target wealth total is below observed total wealth, this approach effectively redistributes wealth from the bottom of the distribution to the top, while subtracting rather than adding anything to the total.

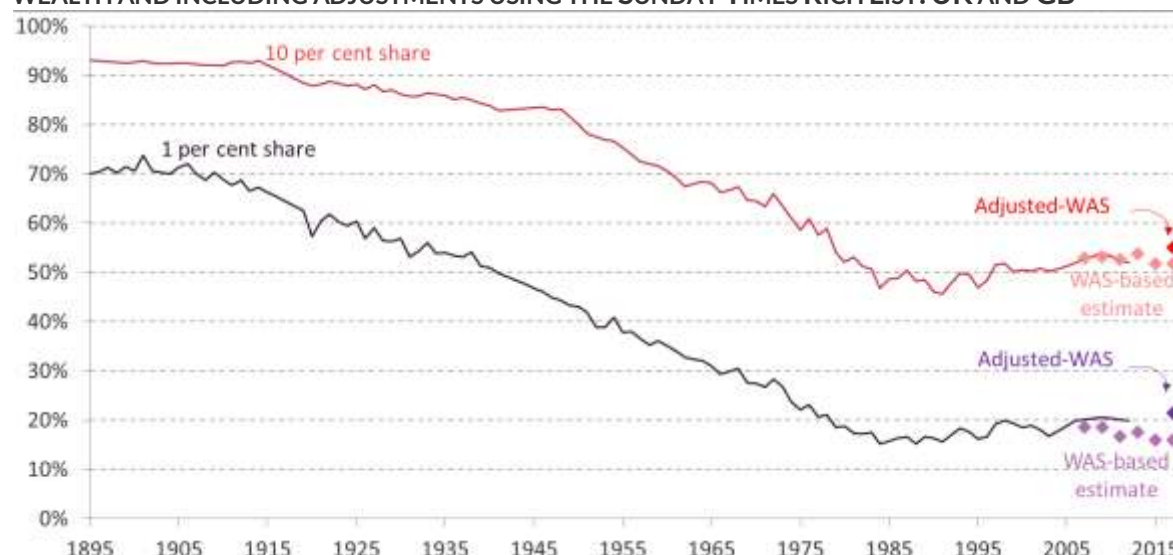
Top shares using alternative measures of wealth

In this section, we present some alternative estimates of the share of wealth at the top of the distribution in order to compare with Alvaredo, Atkinson and Morelli (2018). This is across two

dimensions: (i) rescaling the value of housing wealth in order to match average house prices from Nationwide house price data,⁴⁰ and (ii) excluding pensions.⁴¹

Rescaling housing wealth has a small impact on top shares (Figure A1). Before adjusting for missing wealth at the top, the top 10% (1%) share rises (falls) by 1 percentage point in the period of overlap with Alvaredo, Atkinson and Morelli (2018). Their estimates are based on estates data, which presumably does not include overly optimistic estimates of housing wealth.

FIGURE A1: SHARE OF NET PERSONAL WEALTH HELD BY RICHEST 1% AND 10%, RESCALING HOUSING WEALTH AND INCLUDING ADJUSTMENTS USING THE SUNDAY TIMES RICH LIST: UK AND GB



Notes: The WAS estimates are based on scaling gross property wealth in the WAS down by the ratio of the WAS average house price in round 5 and the contemporaneous average property price in Nationwide data. This equates to a reduction in gross property wealth by around 30 per cent.

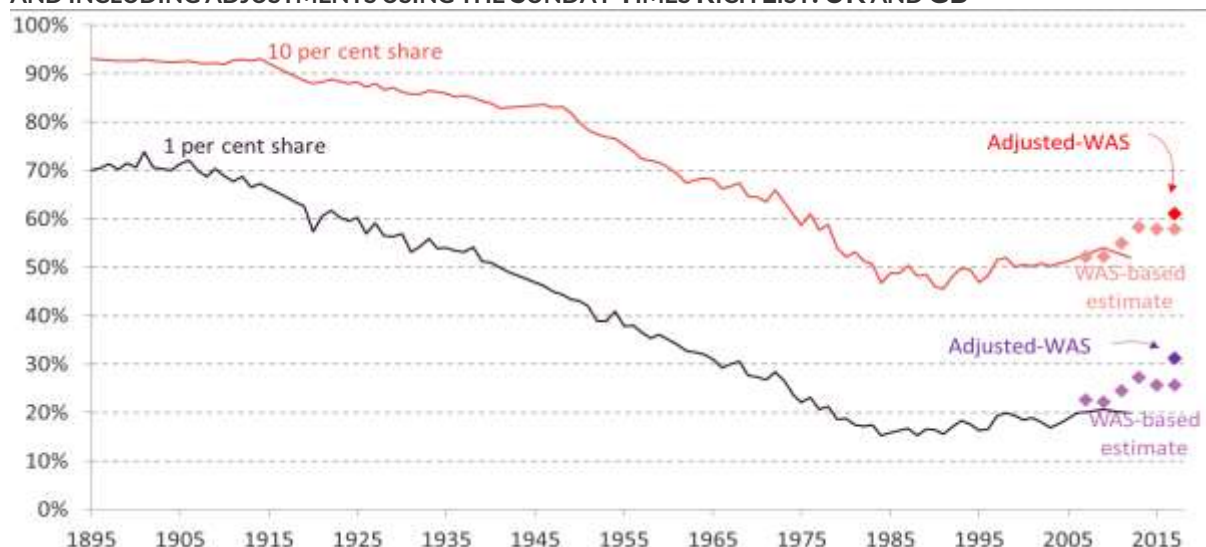
Source: Alvaredo, Atkinson and Morelli, 2018, obtained from the World Inequality Database, 2020; ONS, Wealth and Assets Survey; Nationwide; Sunday Times Rich List.

Excluding pension wealth (Fig. A2) raises our top shares significantly. In 2016–18, the top 1% share was 26% excluding pension wealth, compared to 18% including pension wealth. This is not surprising, given that pension wealth is distributed more equally across the wealth distribution than other sources of wealth, such as financial and business wealth (see Figure 4). Excluding pension wealth also affects the trend in wealth concentration: top shares of non-pension wealth rose significantly between 2008 and 2014, from 23% to 26% for the top 1% and 52% to 58% for the top 10%, continuing the rise in wealth inequality observed since the early 1980s. This is before taking into account wealth at the top which is missing from the WAS. Our Pareto-adjusted top shares for 2016–18 for the top 10% (1%) are 61% (31%).

⁴⁰ The average self-reported house price in the WAS is higher than average UK property prices in other data – for example that compiled by Nationwide. This means housing wealth could be overvalued in the WAS, for example as a result of survey respondents overestimating the value of their own properties.

⁴¹ The long-run comparison time series in these charts is compiled from inheritance tax data which excludes pension wealth. WAS estimates might underestimate top wealth shares relative to the IHT data-based estimate because pension wealth is more evenly distributed than other forms of wealth.

FIGURE A2: SHARE OF NET PERSONAL WEALTH HELD BY RICHEST 1% AND 10%, EXCLUDING PENSIONS AND INCLUDING ADJUSTMENTS USING THE SUNDAY TIMES RICH LIST: UK AND GB

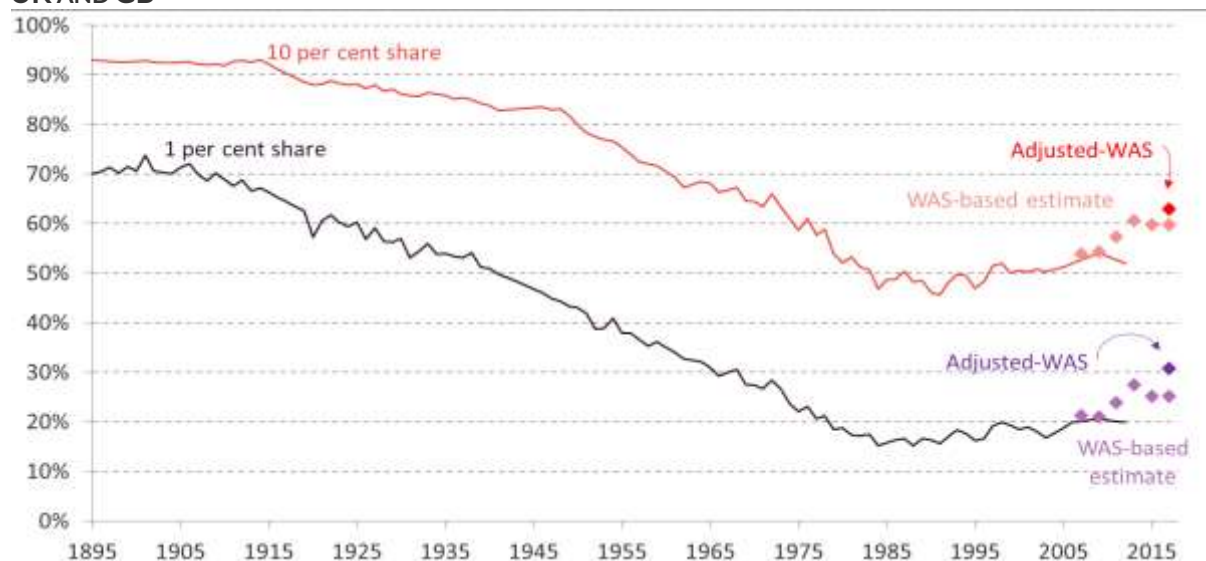


Notes: The WAS estimates exclude all pension wealth, including pensions in payment, occupational and personal pensions.

Source: Alvaredo, Atkinson and Morelli, 2018, obtained from the World Inequality Database, 2020; ONS, Wealth and Assets Survey; Sunday Times Rich List.

In Figure A3, we combine the adjustments made to our wealth definition in the previous two graphs by rescaling housing wealth and excluding pensions. This definition is the most consistent with the wealth definition used in Alvaredo, Atkinson and Morelli (2018). Accordingly, we find that top shares using this definition line up closely with the top shares found in Alvaredo, Atkinson and Morelli (2018) during the years in which the series overlap. Again, these estimates suggest that the rise in inequality observed since the 1980s has not abated in recent years, and if anything has accelerated.

FIGURE A3: SHARE OF NET PERSONAL WEALTH HELD BY RICHEST 1% AND 10%, EXCLUDING PENSIONS, RESCALING HOUSING WEALTH, AND INCLUDING ADJUSTMENTS USING THE SUNDAY TIMES RICH LIST: UK AND GB



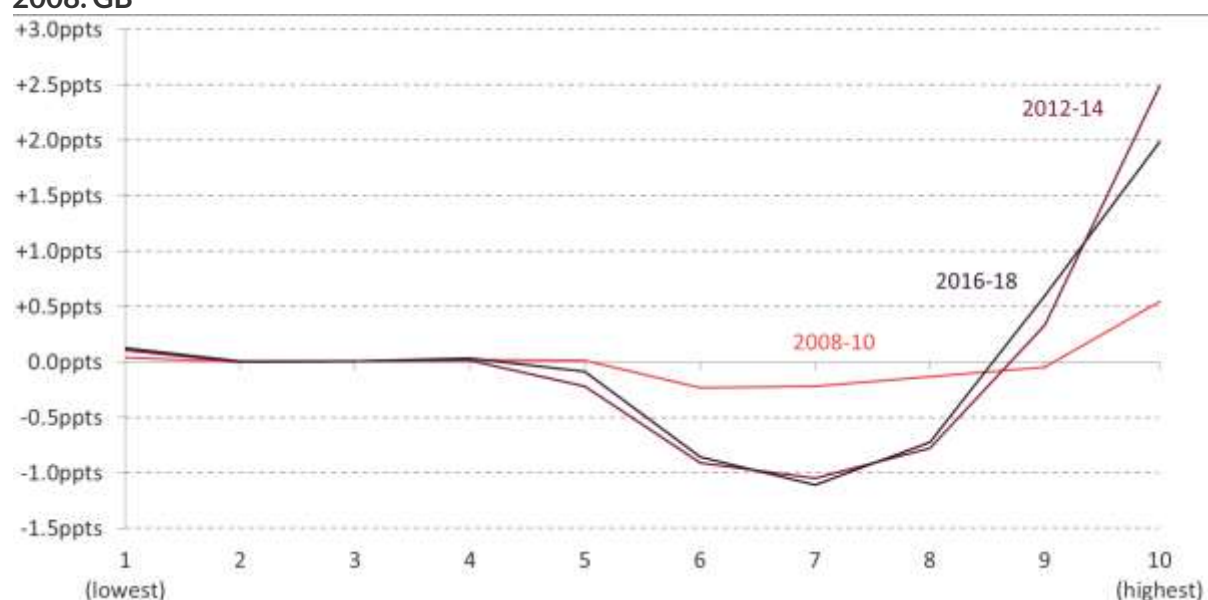
Notes: The WAS estimates are based on scaling gross property wealth in the WAS down by the ratio of the WAS average house price in round 5 and the contemporaneous average property price in Nationwide data. This equates to a reduction in gross property wealth by around 30%. The WAS estimates exclude all pension wealth, including pensions in payment, occupational and personal pensions.

Source: Alvaredo, Atkinson and Morelli, 2018, obtained from the World Inequality Database, 2020; ONS, Wealth and Assets Survey; Nationwide; Sunday Times Rich List.

Appendix B: Inequality in wealth – individual level estimates

In this Appendix we reproduce some of the distributional analysis presented in the body of the paper (Section 3) using individuals as our unit of analysis, rather than family units.

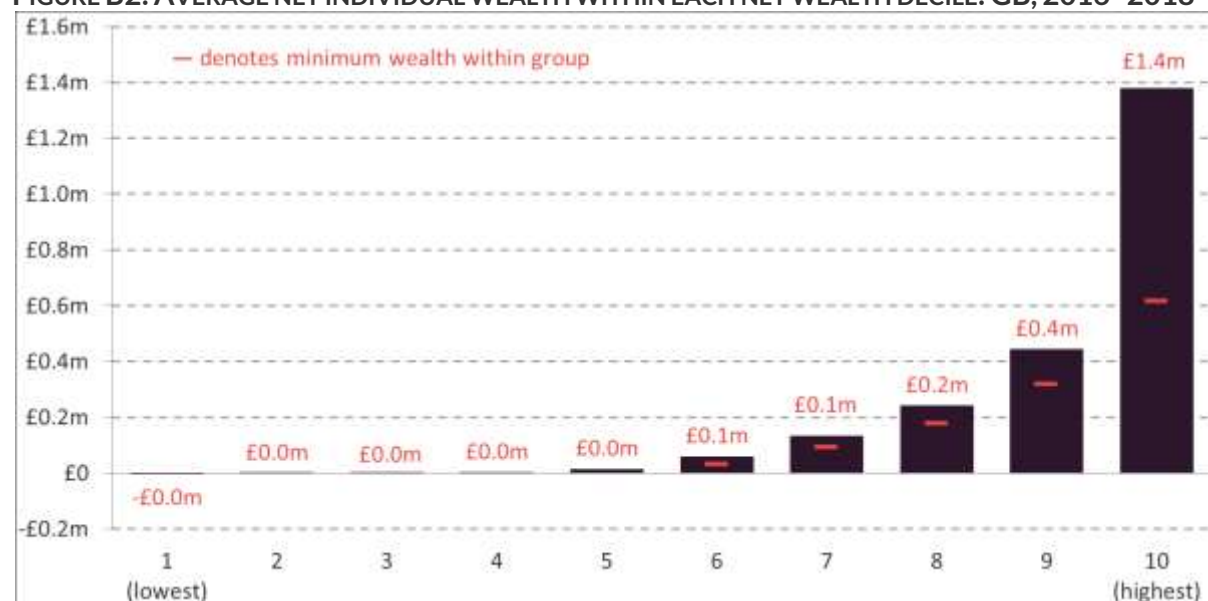
FIGURE B1: SHARE OF TOTAL NET INDIVIDUAL WEALTH BY EACH NET WEALTH DECILE SINCE 2006–2008: GB



Notes: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc). Private business assets are excluded due to material improvements in the coverage of these assets since the early rounds of the survey making cross-round comparisons difficult.

Source: ONS, Wealth and Assets Survey.

FIGURE B2: AVERAGE NET INDIVIDUAL WEALTH WITHIN EACH NET WEALTH DECILE: GB, 2016–2018



Notes: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

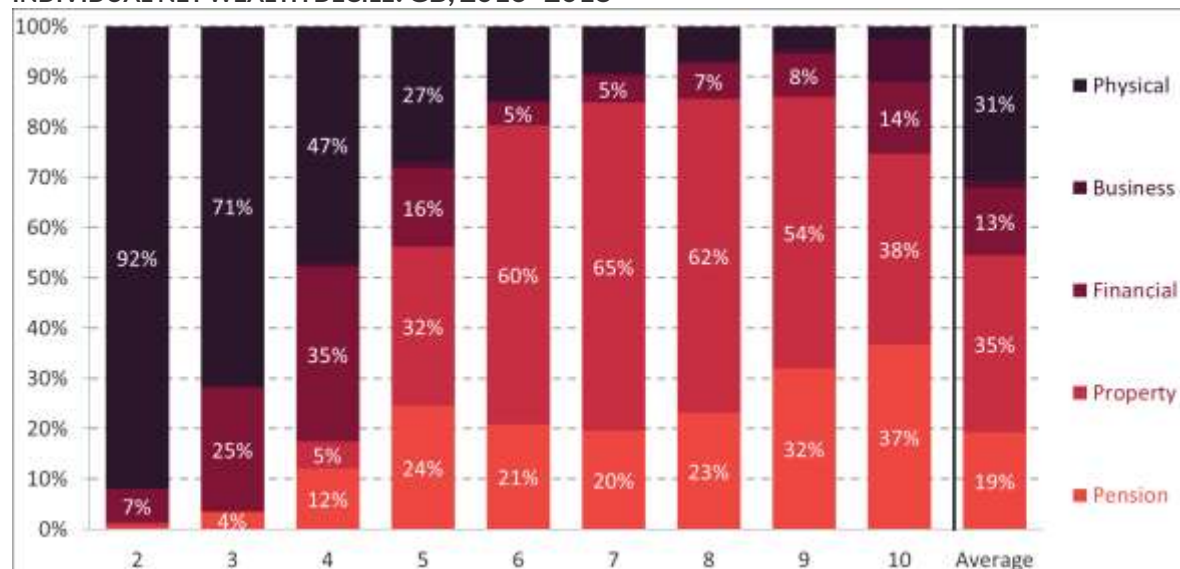
FIGURE B3: AVERAGE NET INDIVIDUAL WEALTH WITHIN EACH NET WEALTH PERCENTILE FOR THE WEALTHIEST 10%: GB, 2016–2018



Notes: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

FIGURE B4: AVERAGE SHARE OF TOTAL NET WEALTH CONTRIBUTED FROM DIFFERENT ASSET CLASSES BY INDIVIDUAL NET WEALTH DECILE: GB, 2016–2018



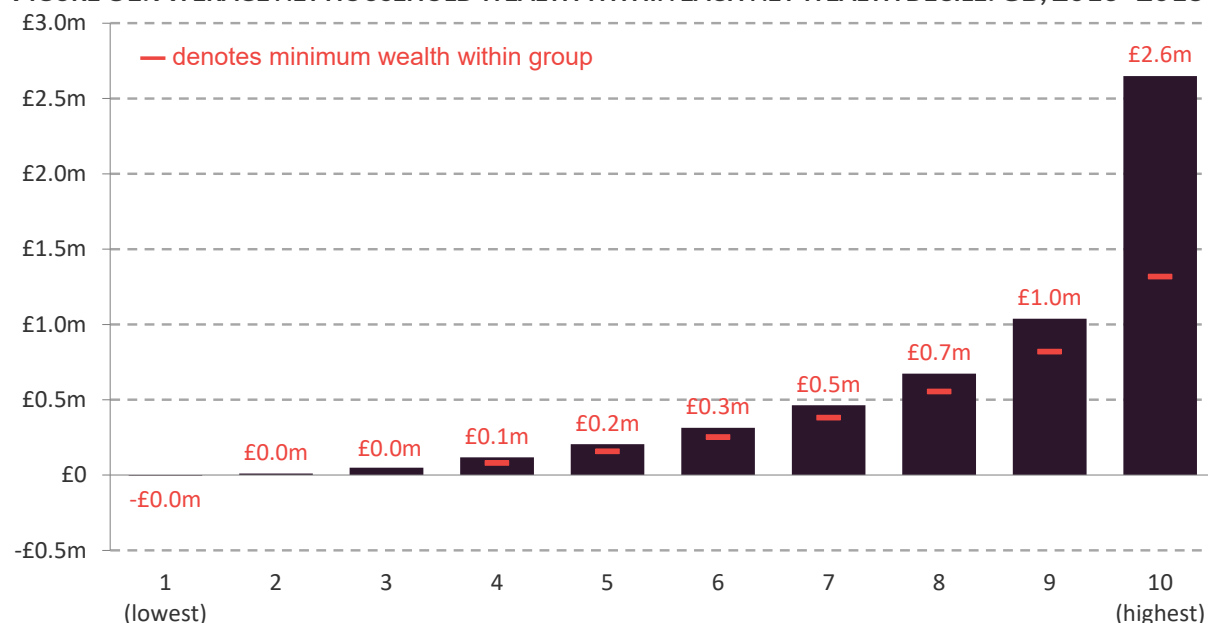
Notes: Individuals are allocated to deciles based on wealth measured at individual level. The lowest decile is excluded as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: ONS, Wealth and Assets Survey.

Appendix C: Inequality in wealth – household level estimates

In this Appendix we reproduce some of the distributional analysis presented in the body of the paper (Section 3) using households as our unit of analysis, rather than family units.

FIGURE C1: AVERAGE NET HOUSEHOLD WEALTH WITHIN EACH NET WEALTH DECILE: GB, 2016–2018



Notes: Wealth is measured at the household level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

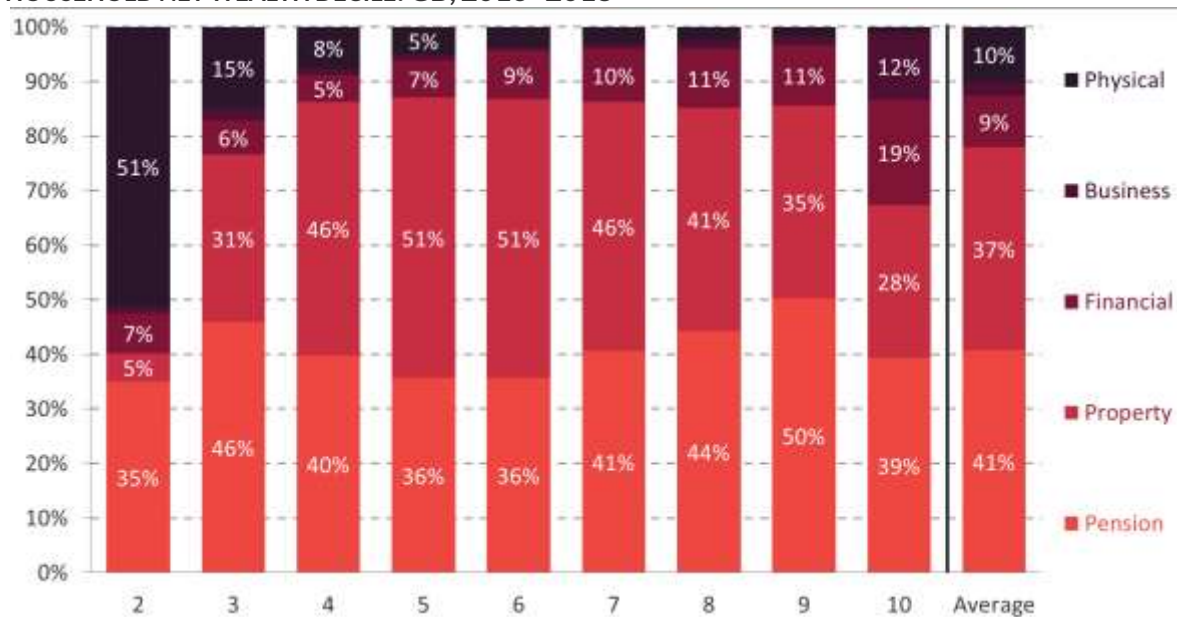
FIGURE C2: AVERAGE NET HOUSEHOLD WEALTH WITHIN EACH NET WEALTH PERCENTILE FOR THE WEALTHIEST 10%: GB, 2016–2018



Notes: Wealth is measured at the household level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

FIGURE C3: AVERAGE SHARE OF TOTAL NET WEALTH CONTRIBUTED FROM DIFFERENT ASSET CLASSES BY HOUSEHOLD NET WEALTH DECILE: GB, 2016–2018



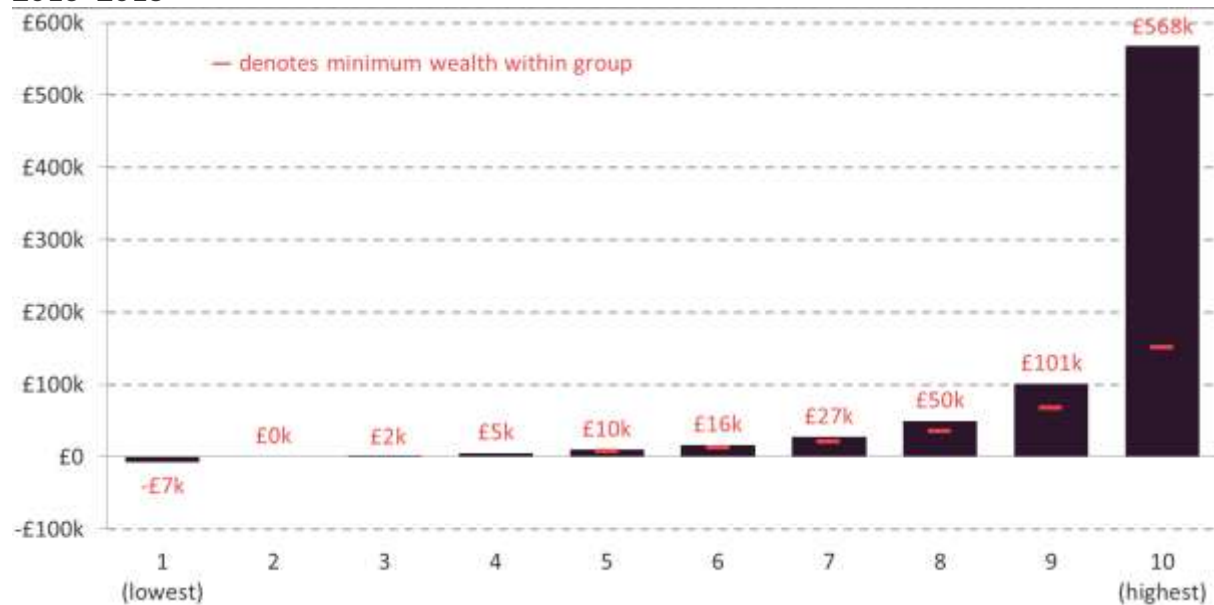
Notes: The lowest decile is excluded, as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: ONS, Wealth and Assets Survey.

Appendix D: Inequality in wealth – family level estimates excluding main residential property wealth and pension wealth

In this Appendix we reproduce some of the distributional analysis presented in the body of the paper (Section 3) using a modified definition of wealth which excludes main residential property and/or pension wealth.

FIGURE D1: AVERAGE NET WEALTH PER ADULT PER FAMILY WITHIN EACH NET WEALTH DECILE: GB, 2016–2018



Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding primary residence and any mortgage attached to it), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

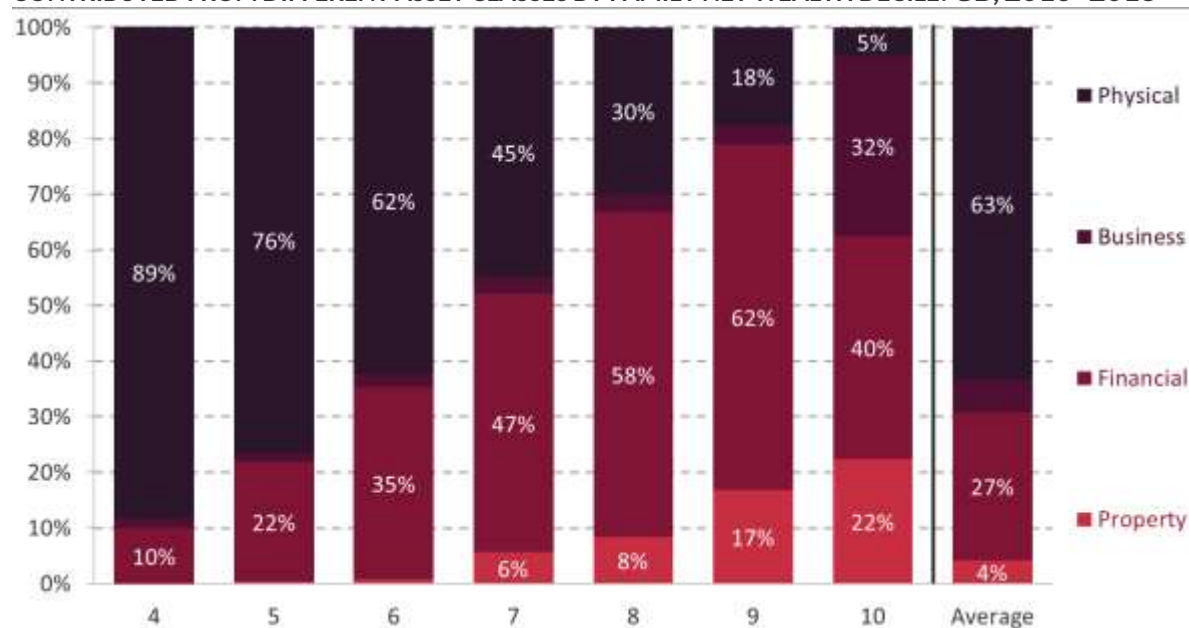
FIGURE D2: AVERAGE NET WEALTH PER ADULT PER FAMILY WITHIN EACH NET WEALTH PERCENTILE FOR THE WEALTHIEST 10%: GB, 2016–2018



Notes: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding primary residence and any mortgage attached to it), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

FIGURE D3: AVERAGE SHARE OF TOTAL NET WEALTH, EXCLUDING PRIMARY RESIDENCES AND PENSIONS, CONTRIBUTED FROM DIFFERENT ASSET CLASSES BY FAMILY NET WEALTH DECILE: GB, 2016–2018



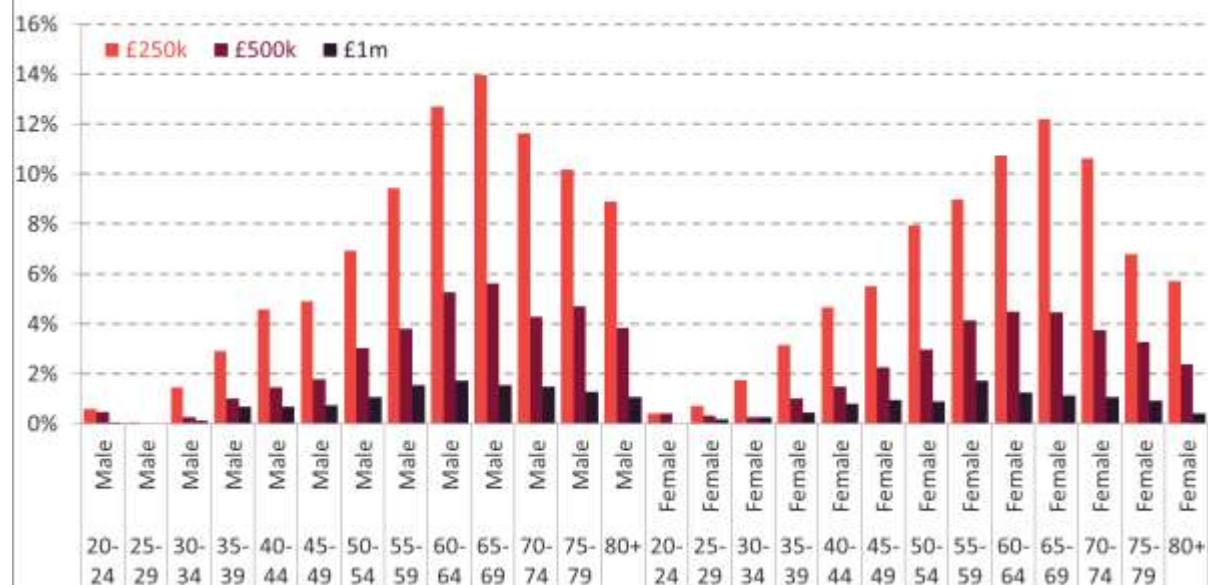
Notes: The lowest three deciles are excluded as net wealth is negative for some components are negative. Property wealth here is measured for non-primary residence properties net of their mortgage debt and financial wealth is net of other financial liabilities. Pension wealth is excluded.

Source: ONS, Wealth and Assets Survey.

Appendix E: Characteristics of high-wealth families excluding main property and pension wealth

In this Appendix, we present evidence on the characteristics of high-wealth families as in the main body of the paper (Section 3.4) using an alternative definition of wealth which excludes main residential property and pension wealth.

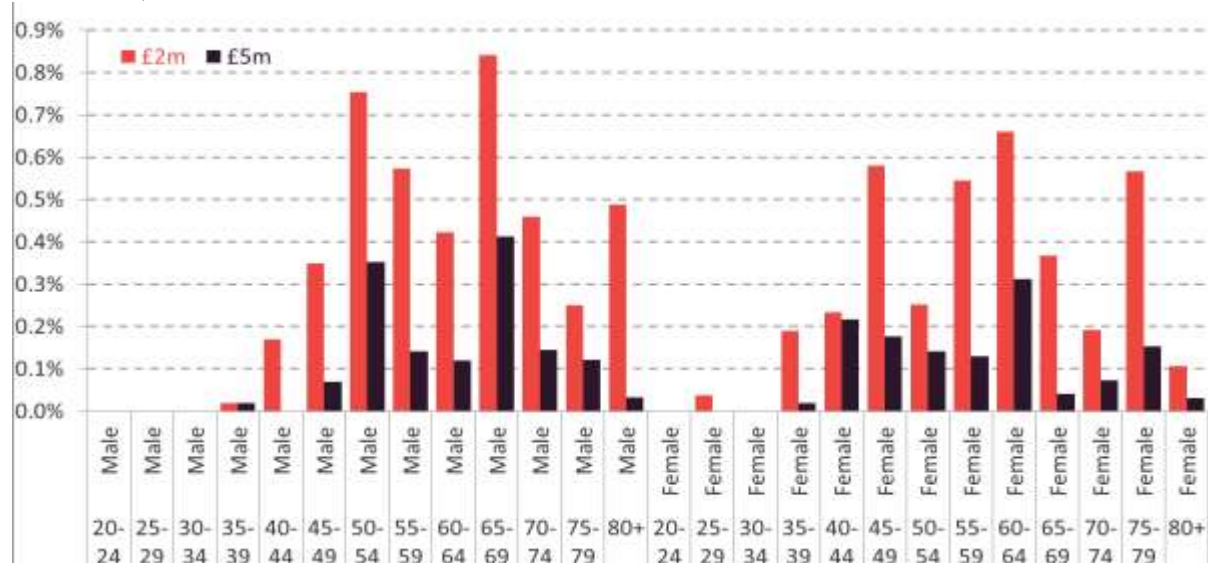
FIGURE E1: SHARE OF AGE AND SEX GROUP THAT LIVE IN HIGH-WEALTH FAMILIES (ABOVE £250,000 PER ADULT): GB 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: ONS, Wealth and Assets Survey.

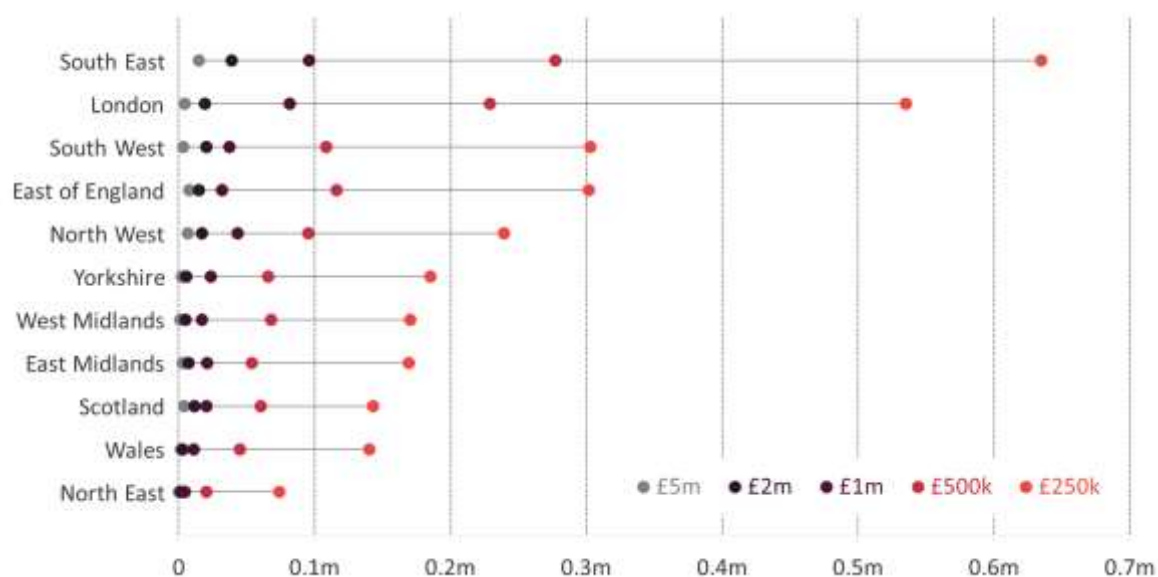
FIGURE E2: SHARE OF AGE AND SEX GROUP THAT LIVE IN HIGH-WEALTH FAMILIES (ABOVE £2 MILLION PER ADULT): GB 2016–2018



Notes: Wealth thresholds are measured as total wealth per adult within the family. Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: ONS, Wealth and Assets Survey.

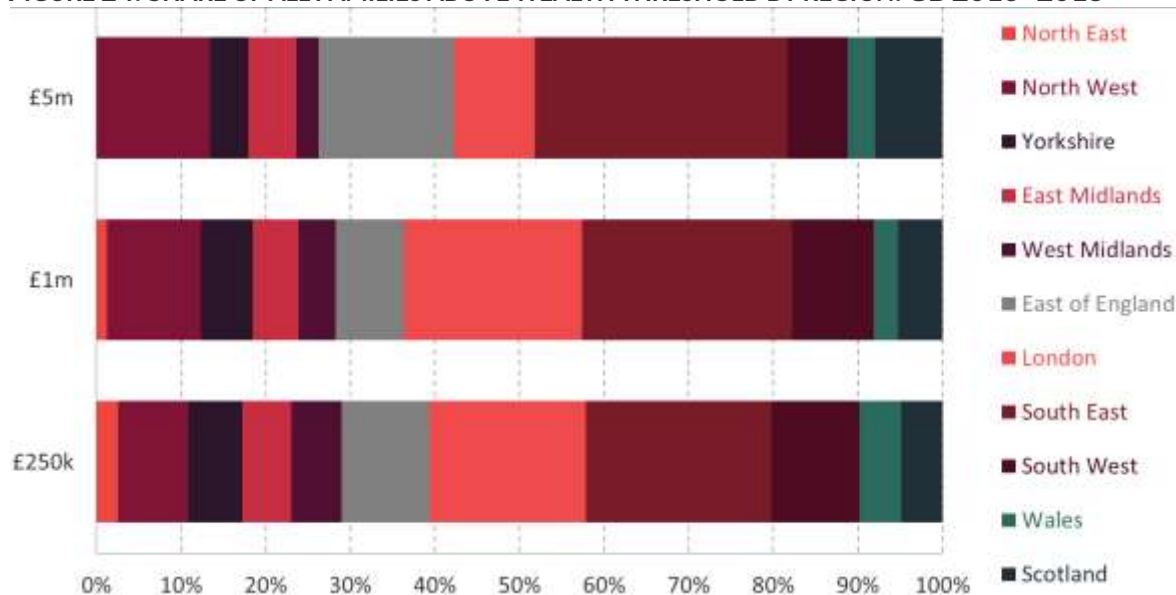
FIGURE E3: NUMBER OF HIGH-WEALTH INDIVIDUALS BY THRESHOLD LEVEL, CALCULATED AT THE FAMILY LEVEL: GB, 2016–2018



Notes: Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: ONS, Wealth and Assets Survey.

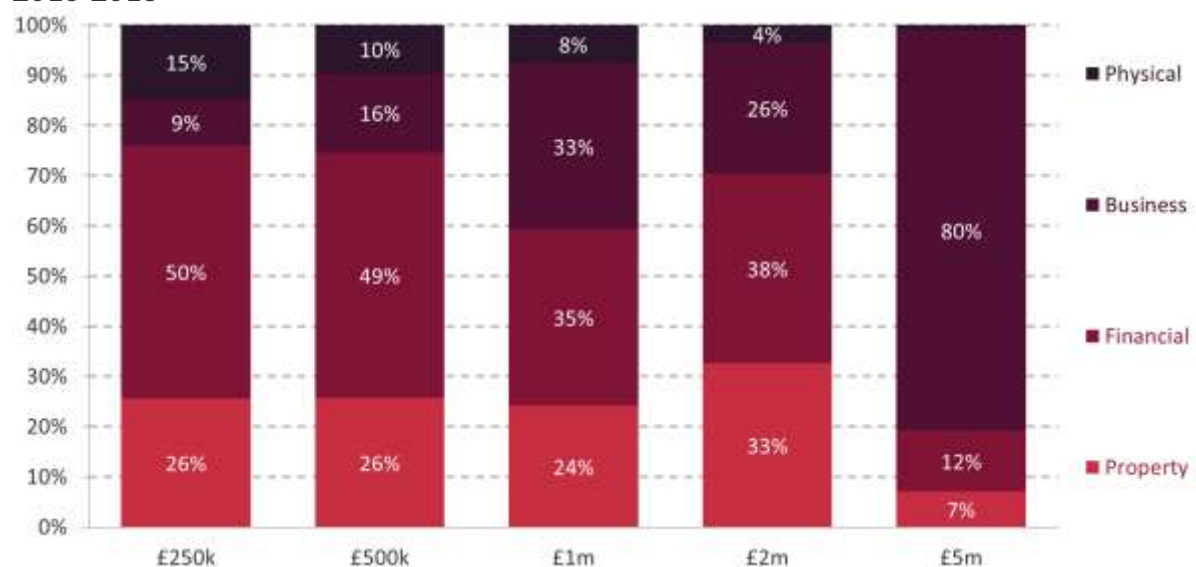
FIGURE E4: SHARE OF ALL FAMILIES ABOVE WEALTH THRESHOLD BY REGION: GB 2016–2018



Notes: Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: ONS, Wealth and Assets Survey.

FIGURE E5: COMPOSITION OF NET WEALTH BY GROUPS CAPTURED BY EACH THRESHOLD: GB, 2016-2018



Notes: Wealth is measured excluding net wealth from the primary residence and pension wealth. It is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding net wealth from the primary residence), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc).

Source: ONS, Wealth and Assets Survey.

Appendix F: Relationship between age and wealth

In this appendix we present some additional evidence on the relationship between age and wealth, and the distribution of wealth among those at the peak of their life-cycle of wealth accumulation.

Table F1 shows where in the distribution an individual who is aged 40-44 with median family wealth (£126,000) would be if we were to place them in the wealth distribution for a different age group. This highlights the fact that what is considered ‘typical wealth’ for someone aged 40-44 would be ‘high wealth’ for someone a decade or two younger, and ‘low wealth’ for someone a decade or two older. This pattern reflects the life-cycle evolution of wealth holdings: people accumulate wealth during the early stages of their working lives, and decumulate in retirement.

TABLE F1: WHERE IN THE CONDITIONAL WEALTH DISTRIBUTION, CONDITIONING ON AGE GROUP, A 40-44 YEAR OLD WITH MEDIAN FAMILY WEALTH WOULD BE

Age	Percentile of distribution which matches 40-44 median
20-24	99
25-29	93
30-34	80
35-39	64
40-44	50
45-49	40
50-54	35
55-59	28
60-64	24

Notes: Wealth is measured at the family level, and percentiles are defined relative to the number of families.
Source: ONS, Wealth and Assets Survey.

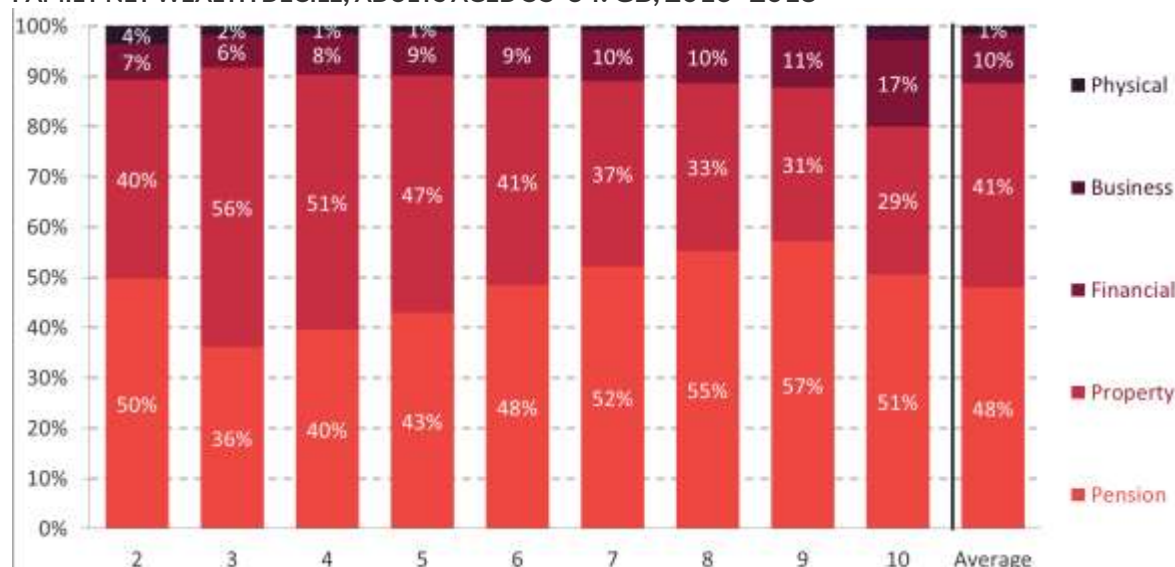
To better understand the distribution of lifetime resources, it is instructive to look at the distribution of wealth among individuals at the peak of the accumulation phase, immediately before retirement: at this point measured wealth provides a better indication of the total amount of resources available to individuals over their life-cycle, which is likely to be a good proxy for welfare. This group are also likely to pay a disproportionately large share of any wealth tax (as well as other capital taxes), so they are particularly policy relevant (Advani, Hughson and Tarrant, 2021). An important caveat here is that wealth accumulation among younger cohorts is much lower than it was for the individuals aged 55-65 in our sample, so it is not clear how stable these patterns will be over time (Bourquin, Joyce and Sturrock, 2020).

Figure F1 shows the composition of wealth by asset class across the wealth distribution, as per Figure 4, focusing on adults in the pre-retirement phase (aged 55-64). Unsurprisingly, pension and property wealth account for a much larger share of wealth for this age group (89%) than for the population as a whole (69%), while the role of physical assets diminishes (in relative terms). Unlike the general population, those at the lower end of the distribution of adults aged 55-64 have accumulated a significant proportion of their wealth in property, this being the dominant

asset among those in the third and fourth decile. This is likely to reflect a combination of the life-cycle accumulation of wealth, as well as higher rates of home-ownership among older cohorts.

Strikingly, throughout much of the distribution, adults aged 55-64 hold a consistent share of their wealth in a combination of pensions and property (around 90%), with the role of pensions in that mix becoming more important higher up the distribution. It is only in the top decile of this age group that financial and business wealth start to become more important, accounting for 20% of wealth.

FIGURE F1: AVERAGE SHARE OF TOTAL NET WEALTH CONTRIBUTED FROM DIFFERENT ASSET CLASSES BY FAMILY NET WEALTH DECILE, ADULTS AGED 55-64: GB, 2016-2018

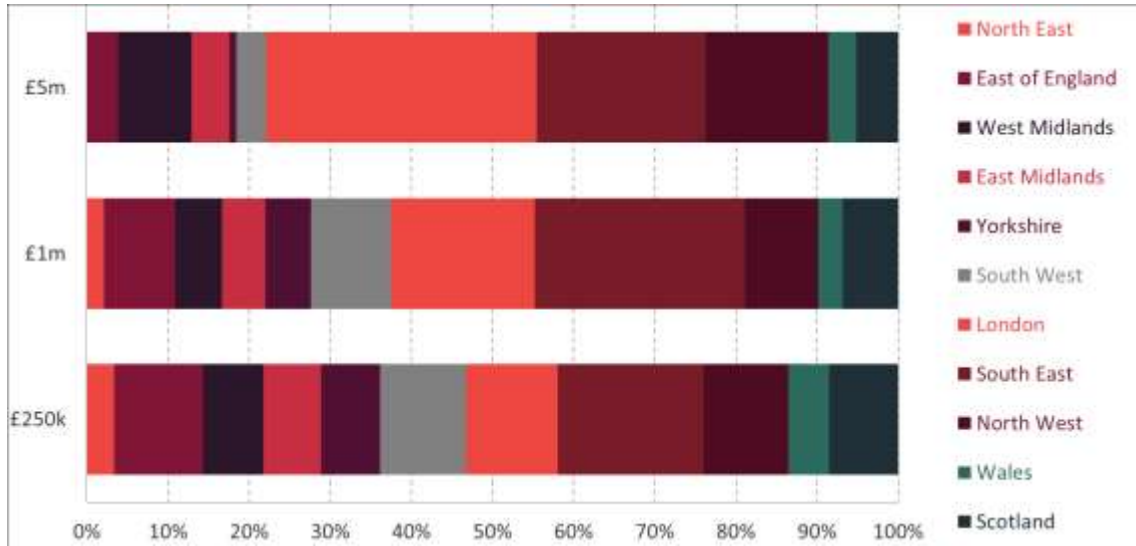


Notes: Individuals are allocated to deciles based on wealth measured at family level. The lowest decile is excluded as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: ONS, Wealth and Assets Survey.

Figure F2 illustrates the geographical distribution of high-wealth individuals in the 55-64 age range. The pattern is broadly the same as for the population as a whole (Figure 12), with the exception of individuals with wealth above £5m, where those aged 55-64 are much more likely to live in London compared to other individuals with the same level of wealth.

FIGURE F2: SHARE OF ALL FAMILIES ABOVE WEALTH THRESHOLD BY REGION, INDIVIDUALS AGED 55-64: GB 2016-2018



Notes: Wealth thresholds are measured as total wealth per adult within the family.
Source: ONS, Wealth and Assets Survey.

Appendix G: Sensitivity of Pareto estimation to alternative thresholds and definitions

As discussed in Section 4, there are two key challenges in estimating the Pareto distribution which underlies the top tail of the wealth distribution. First, accounting for the difference in definition/coverage of wealth between the WAS and the STRL. Second, identifying the appropriate threshold above which the true wealth distribution in the UK can be approximated with a Pareto distribution. This appendix presents sensitivity analysis for both of these issues.

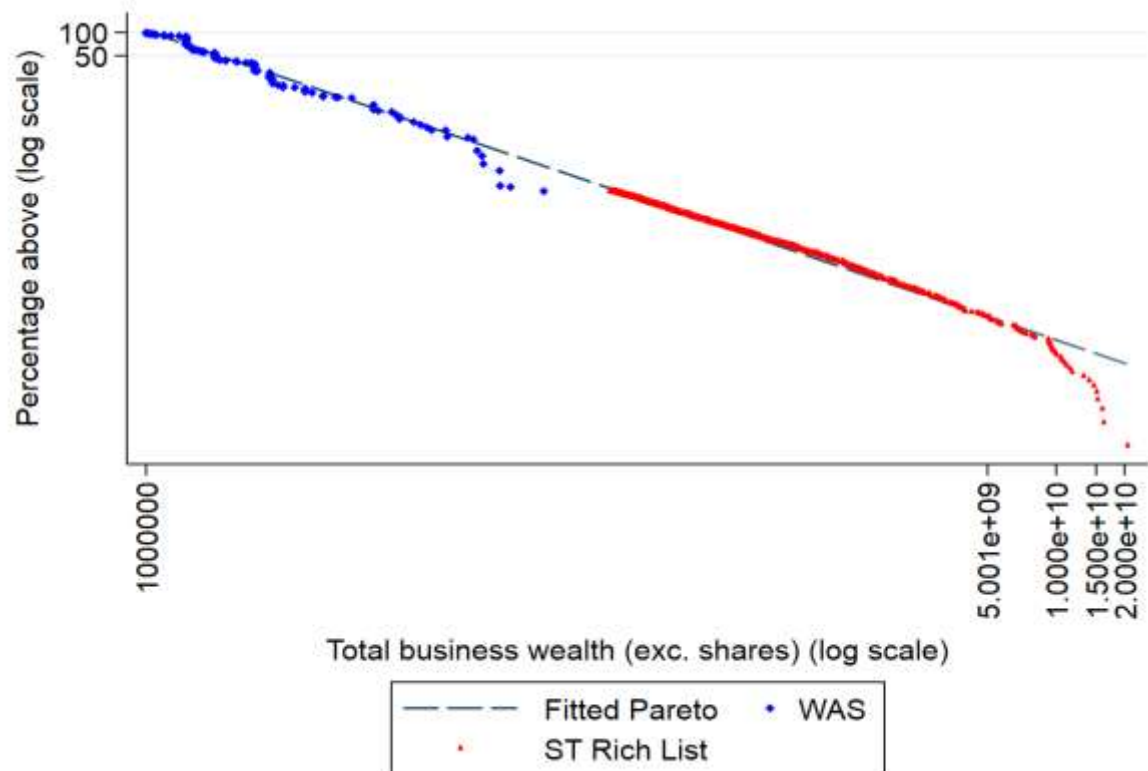
Figure G1 and G2 present alternative definitions of wealth in the WAS combined with the STRL and the fitted Pareto distribution. Figure G1 restricts wealth in the WAS to only private business wealth as we can be confident that this is captured in the STRL as this forms the key input to many top-wealth families' assets. Figure G2 takes the opposite approach and includes all wealth identified in the WAS. The definition of wealth used in the main body of the paper remains our preferred specification, given the coverage of the STRL. However, these results show that the Pareto distribution is a reasonably good approximation regardless of WAS wealth definition.

Finally, Table G1 tabulates the resulting estimate of wealth missing from the WAS and STRL samples, based on the fitted Pareto distribution generated under different wealth definitions and thresholds. We observe that the Pareto index is considerably lower when estimated using Business (and Financial) assets than when total wealth is used. This is partly because the former is much more concentrated than the latter.

In estimating total wealth, we sum up the predicted values of wealth for each observation in the data, according to the fitted Pareto distribution. An alternative method would be to calculate the total top tail wealth implied by the form and parameters of the Pareto distribution, which is given by $N \cdot \frac{\alpha}{\alpha-1} \cdot w_{min}$, where N is the sum of household weights above the Pareto threshold and $\frac{\alpha}{\alpha-1} \cdot w_{min}$ is the average wealth above the threshold, for $\alpha > 1$. However, for $\alpha < 1$, as in our case, a finite solution for the mean does not exist, and so we adopt an empirical approach to estimating the total wealth expected to be held by those in the top tail. Even for α above but close to one, the two approaches can yield very different results. This is because low values of α imply that wealth is highly concentrated, and hence fitted Pareto distributions can imply that a

significant – and often implausible – proportion of wealth in the top tail is held by individuals with wealth far exceeding the maximum value observed in the data. This is an important issue to consider in using Pareto methods to estimate the top tail of the wealth distribution.

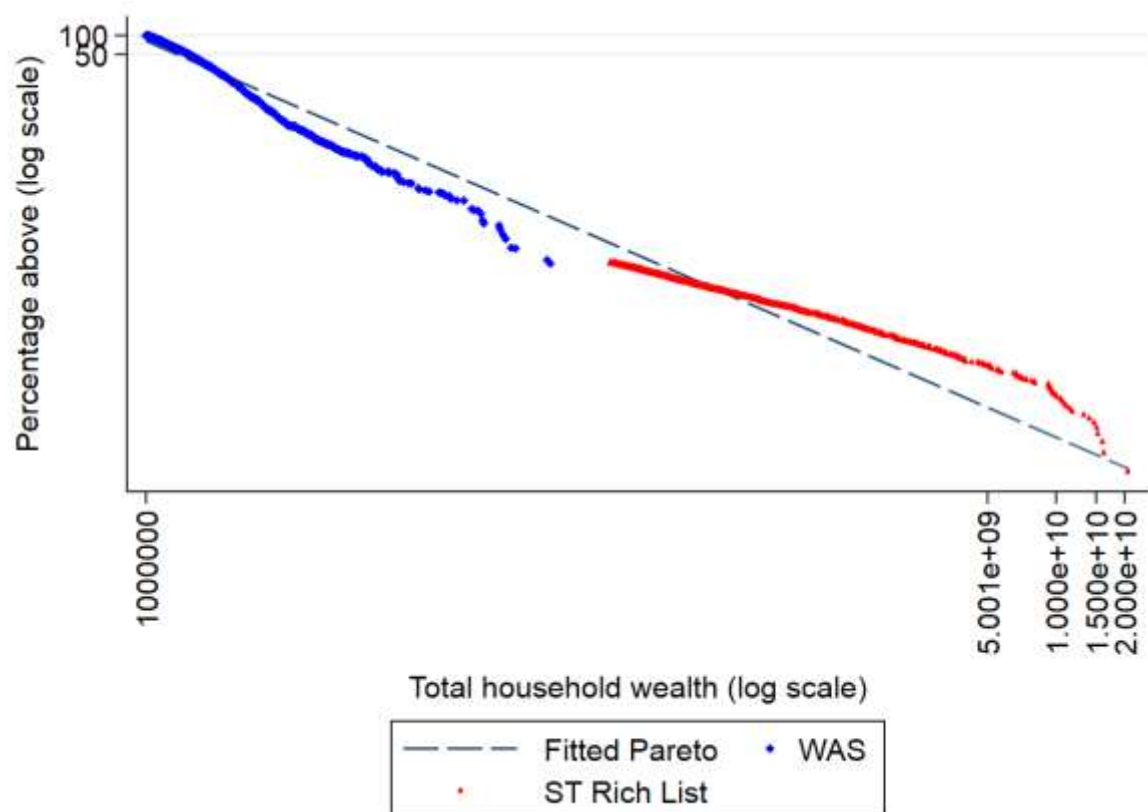
FIGURE G1: ESTIMATE PARETO DISTRIBUTION USING WAS BUSINESS ASSETS AND THE STRL (LOWER BOUND THRESHOLD OF £1 MILLION)



Notes: Estimation suggests there is missing wealth in WAS/STRL relative to the fitted Pareto distribution amounting to £470 billion.

Source ONS, Wealth and Assets Survey; Sunday Times Rich List.

FIGURE G2: ESTIMATED PARETO DISTRIBUTION USING WAS MEASURE OF TOTAL WEALTH AND THE STRL (LOWER BOUND THRESHOLD £1 MILLION)



Notes: Estimation suggests there is missing wealth in WAS/STRL relative to the fitted Pareto distribution amounting to £950 billion.

Source ONS, Wealth and Assets Survey; Sunday Times Rich List.

As discussed in Section 4 of the paper, the Pareto adjustment results are very sensitive to the definition of wealth, and to a lesser extent also sensitive to the threshold above which the true underlying wealth distribution matches a Pareto distribution. This table provides an indication of that sensitivity as well as the key estimation statistic – the Pareto index alpha – which should be stable at the appropriate cut-off threshold (Vermeulen, 2018). As the table shows, there is no clear indication of the appropriate threshold when total household wealth is used. With our preferred measure of business wealth, the choice of threshold makes very little difference to the Pareto index.

TABLE G1: SUMMARY RESULTS FROM PARETO ADJUSTMENT BASED ON DIFFERENT THRESHOLD LEVELS AND DEFINITIONS OF WEALTH

Threshold	Definition of WAS wealth	Additional wealth	Pareto index alpha
500k	Business and financial	+£330 billion	0.98
1m	Business and financial	+£360 billion	0.97
2m	Business and financial	+£400 billion	0.97
3m	Business and financial	+£430 billion	0.98
4m	Business and financial	+£440 billion	0.99
5m	Business and financial	+£440 billion	0.99
500k	Business assets only	+£460 billion	0.93
1m	Business assets only	+£470 billion	0.94
2m	Business assets only	+£490 billion	0.97
3m	Business assets only	+£490 billion	0.98
4m	Business assets only	+£480 billion	0.99
5m	Business assets only	+£470 billion	0.99
500k	Total wealth	+£1.0 trillion	1.57
1m	Total wealth	+£950 billion	1.56
2m	Total wealth	+£220 billion	1.45
3m	Total wealth	-£150 billion	1.32
4m	Total wealth	-£250 billion	1.20
5m	Total wealth	-£230 billion	1.14
6m	Total wealth	-£170 billion	1.10
7m	Total wealth	-£90 billion	1.07
8m	Total wealth	-£50 billion	1.05
9m	Total wealth	£0 billion	1.04

Notes: Estimates of additional wealth are similar across different thresholds using our preferred definition of business wealth including shares. Excluding shares does not have a significant effect on the estimates. Estimates based on total wealth are notably different and relatively more unstable when different thresholds are used. Source ONS, Wealth and Assets Survey; Sunday Times Rich List.